

Wet-Rice Cultivation in Bali: The
Continuity of Technology and Social
Organisation from the 9th Century
to the Present

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Except where otherwise indicated this
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Chapter 1

Introduction

1.1 Aim and Scope of the Present Study

The main purpose of this study is to examine the historical continuity of technology and social organization within the Balinese system of wet-rice cultivation. This will be demonstrated by reference to three time periods, the ancient Balinese period (9th-12th centuries AD), the Dutch colonial period (1908-1945), and the most recent period from 1945 to the present.

These time divisions have been chosen because direct observational data relevant to this study are available for them. The large gap between the 12th and 19th centuries is due to a lack of direct information concerning both the technology and social organization of wet-rice production during this period. However, by contrasting and comparing the available data from the three chosen periods, this study aims to reconstruct the continuities within the system of wet-rice cultivation in Bali.

The ethnography of contemporary Bali is useful for such reconstruction because Balinese culture has not been subject to the same degree of modern perturbation as that of the other islands of the Indonesian archipelago, and thus it has remained fairly stable. Geertz (1980: 8-9) argues:

“...although Balinese life did change significantly between the fourteenth and nineteenth centuries, the change was to a very great extent endogenous. In particular, two revolutionary events that elsewhere radi-

cally transformed the social and cultural order, Islamization and intense Dutch domination, did not occur in Bali. Thus, though the island's history is no less dynamic than that of the other Indicized regions of the archipelago, it is far more orthogenetic and a good deal more measured. Bali in the latter half of the nineteenth century may not have been a mere replica of Bali in the middle of the fourteenth, but it was at least fully continuous with it, a reasonably regular development out of it. As a result, much that had been erased or altered beyond recognition in Java or the coastal regions of Sumatra remained in Bali. No cultural fossil, this tight little island was none the less, like Tibet or Yemen, culturally quite conservative."

In order to collect data on modern rice cultivation in Bali, a two month period of field work was conducted in three villages in *kecamatan* (district) Abang of *kabupaten* (regency) Karangasem, eastern Bali. The research was focused on the functions of *subak* institutions and the traditional technology of wet-rice cultivation. A *subak* is an autonomous body consisting of farmers whose rice fields are fed by a major canal or one of its branches (Liefcrinck 1969; Geertz 1972; Birckelbah 1973) The main functions of a *subak* are to organize and distribute irrigation water and to coordinate the building of new irrigation systems and the repair and maintenance of existing ones. Considerable variation is found in the specific terminologies and the detailed organizational structures associated with *subaks* throughout Bali. This is due to geographical variation in water sources, varying size of holdings and the numbers of *subak* members, and local socio-economic contexts and traditions.

This study is concerned with the traditional technology of Balinese wet-rice production and its social organization in one region. This information is then related to aspects of the social system of traditional Balinese culture, and generalizations can be made concerning wet-rice cultivation and its role in the organization of Balinese society from the 9th century AD to the present day.

1.2 Data and Problems

Unlike Sri Lanka, Burma and Cambodia, where large ancient water systems still exist, no physical remains have been found of the ancient water systems of Bali. This is partly because of differences in the kinds of materials used in constructing the systems. In Sri Lanka, Burma and Angkor these systems were sometimes made from stone and plastered brick. In contrast those in Bali comprises features which do not survive so well through time, such as unlined canals, ditches and dikes; coconut trunks and logs for dams and water dividers; and bamboo for inlet and outlet pipes to the individual holdings. The Balinese system also has been re-used and modified on the ancient base and as a consequence many traces of its early configuration have been lost. Another problem is the fact that no botanical remains of ancient rice have ever been uncovered in Bali, because of the lack of research in the area. This differs from the situation in Thailand (Gorman 1977; Higham 1984), Vietnam (Higham 1984), China (Chang 1986) and India (Vishnu-Mittre 1974; 1977) where rice remains have been uncovered from many prehistoric sites.

Data on the ancient Balinese, colonial and modern periods have been accumulated from a wide range of sources. Information on the technology and social organization of wet-rice cultivation in ancient Bali has come from stone and copper plate inscriptions. These have been examined, translated and published primarily by Dutch scholars, followed later by Indonesians.

Since the inscriptions provide information about human activities in the past, they are very important for the archaeologist. They are still kept by Balinese as sacred objects in temples, and this can causes difficulties to epigraphers who wish to examine them. Through the mediation of government institutions these inscriptions have been examined by archaeologists who have fulfilled certain religious requirements set by the Balinese. For instance, they must undertake a ceremony strictly on a specified date, witnessed by the villagers, before they are allowed to read the inscriptions. Sometimes the inscriptions are in poor condition, or they are found incomplete, and present difficulties in reading and interpreting the contents. Some words no longer in use cannot be understood, especially concerning taxes and court officials. Copies of some original inscriptions were often made later to consolidate

the decree of a previous king. This practice can lead to confusion for epigraphers, particularly in reconstructing historical events in chronological order. In dealing with such copied inscriptions the researcher always tries to find the original inscription in the text of new one, and then continues to the second edict by searching for the word *punah* or *muwah* (Goris 1965:39; van Setten 1979:xvi). Actually the word *muwah*, occurring originally in Goris is evidently a mis-print, which should read *lumah*, meaning deceased (of the king) as does *punah*.

To date there has been no review of ancient wet-rice cultivation in Bali. There are descriptive reports by Sukarto (1983), Wardha (1986) and Tara (1987) concerning ancient wet-rice cultivation. These provide some evidence for the existence of both wet and dry rice cultivation, for the office of head of a *subak*, the office of tunnel builder, and for the institutionalization of different stages of rice cultivation. This material will be examined in order to construct a synthesis of the technological, social and ritual aspects of wet-rice cultivation in ancient Bali.

Data concerning wet-rice cultivation during the Dutch colonial period come from ethnographic reports by Dutch scholars in the 19th century. F.A. Lieftrinck, resident of Bali and Lombok from 1896 to 1901, was interested in examining the *subak* irrigation system of Bali. His work is a well-documented study and a valuable source for understanding the social and economic structure of Balinese wet-rice cultivation in that period. Lieftrinck's interest was taken up by another Dutch scholar, C.G. Grader (1939), who was also interested in *subaks*. Grader did his research in Jembrana, Western Bali, focusing on irrigation and social organization. Wirz (1927) concentrated on the cults associated with rice cultivation in Balinese society.

In the chapter which follow, chapter 2 will give an overview of rice, its nature and origin, and irrigation and terracing technique.

Chapter 3 focuses on colonial and contemporary cultivation methods, which do not differ significantly. The *subak* social structure is examined, as well as the maintenance of the crucial water reticulation and irrigation system which is the main responsibility of the *subak*. A brief description of a Balinese village is included to provide a background to these issues. This study does not deal with the impact of modern agricultural trends on the social economy in Balinese society, but rather

solely examines the traditional method of rice-growing and its social organization. This chapter also outlines the contemporary use of technology and methods of wet-rice cultivation, including land preparation, planting and harvesting, and important ceremonies associated with the phases of cultivation. It also treats the impact on the rice-growers of the period of Dutch rule (1908-1945) and the subsequent incorporation of Bali into the Republic of Indonesia. The extent of taxation under the two regimes is briefly examined, as is the obligation of the *subak* to supply unpaid labour to the Dutch colonial authorities.

Chapter 4 analyses ancient Balinese wet-rice cultivation methods, including the technology of irrigation and cultivation; social organization; issues of taxation; and land and water rights. Primary data sources for this chapter are the copper plate inscriptions, dating between the 9th and the 12th centuries AD, which provide an insight into rice cultivation practices of the period as well as the other issues outlined above, thereby providing a basis for comparison with data relating to the modern (20th century AD) period.

In chapter 5 these data are compared, to establish the level of continuity of technology and social organization of rice-growing in Bali through these time periods.

Chapter 2

Background

To give a general understanding of the relationship between wet-rice cultivation and social organization in Balinese society, it will be useful to look at some of the general questions associated with rice, its origins, nature, and the technology of its cultivation.

2.1 The Nature of Rice

There are a number of species of rice distributed throughout the world. These occur in tropical, sub-tropical and warm temperate regions. The most commonly cultivated species is *Oryza sativa*. There are thousands of varieties of this species, which can be grown with success over a wide range of environments varying in soil and water conditions, in relief, and in rain fall.

Oryza sativa is divided into two groups, known as *japonica* (or *sinica*) and *indica*, both of which include glutinous and non-glutinous varieties. The temperate zone varieties are known as *japonica* (or *sinica*) and the tropical ones as *indica*. This classification was made by Japanese botanists in the 1920s. The *japonica* varieties have a short round grain, which becomes sticky when cooked. They have narrow, dark green leaves and long thick hairs on the glumes. They have a short stalk and are high yielding, particularly in response to heavy applications of nitrogen fertilizer. They are more tolerant of low temperatures and may grow and develop more quickly than *indica* when the temperature of the water is low.

The *indica* varieties have a longer and narrower grain which is non-sticky when it is cooked. They respond to nitrogen fertilizers by an increased production of stem, not grain. The stem is weak, tends to fall over, and the seeds will not germinate under water. Therefore, seedlings must be grown in a nursery and transplanted, or else sown in moist rather than flooded soil (Grist 1959:73-4).

Based on their response to day length, rice varieties are divided into two groups, sensitive and non-sensitive. *Japonica* varieties are sensitive to day length and are suited to long days. They are widely grown in Japan, North China and Korea. They do poorly in the short-day tropics.

Two main group of rice varieties are found in Indonesia, known as the *bulu* and *cereh* groups. *Bulu* is a sub-group of *japonica* and is also called *javanica*; while *cereh* is an *indica* type. Both groups are grown in Java, Madura, the southern part of Sumatra and Sulawesi. Only *cereh* is grown in Kalimantan, while only *bulu* is grown in Lombok and Bali (Yamada 1975:58-59). *Bulu* varieties have a wide leaf, and the grains are large and round, their seed dormancy period is relatively short and they require good soil but have poor resistance to disease and pests. In contrast, the *cereh* varieties have a narrower leaf, small and long grains, and a long seed dormancy period. They can be grown in poor soil, and have a great resistance to disease and pests (ibid, p. 58).

The recently developed high-yielding varieties (H.Y.Vs.) have come to play an important part in Asian rice production since the 1960s. These are derived from semi-dwarf mutants of *indica* rices. These types are mostly quick ripening, permitting double or even triple cropping in each year. They respond positively to chemical fertilizer, often yielding more than half as much again as traditional varieties. In 1967 the IR 8 and IR 5 varieties, two modern varieties from the International Rice Research Institute (I.R.R.I.), were introduced by the Indonesian government, an event which marked the beginning of the "green revolution" in Indonesia (Ward 1985:12).

The rice varieties may also be divided into two other classes, the glutinous and non-glutinous rices. Glutinous rice has a soft and dull grain, and stalks that are soft and tend to lodge. The grains are generally large, and in various colours.

In fact glutinous rice does not contain gluten, but derives its stickiness from the endosperm which contains soluble starch and dextrin, with some maltose (Grist 1959:78). Glutinous rice becomes sticky and sweet when it is cooked, is harder to digest and usually contains less protein than the non-glutinous type, but contains distinctly more fat. Glutinous rice is usually used for special dishes like cakes, fermented rice and alcoholic beverages. It is cultivated in almost all Asian countries, including China, Japan, Burma, Thailand, Philippines and Indonesia.

Glutinous rice is also highly valued as a ceremonial food in some Asian countries. Colored glutinous rice cakes decorated with eggs and flowers are given to brides as a symbol of fertility in Malaya. It is steamed and wrapped in bamboo leaves, and is exchanged on the day of the Dragon Boat Festival in Southern China (Bray 1986:18). Moerman (1968) states that glutinous rice in northern Thailand is viewed by the Lue villagers as a mark of both ethnic and political identity.

In Bali, glutinous rice also plays a very important part in Balinese ceremonies and festivals. Almost all Balinese offerings contain cakes and crackers which are basically made from glutinous rice. Some are dyed different colours like bright yellow, red, green, pink, and black; and they take various shapes like animals, plants, flowers and humans. They may be arranged in a certain form together with flowers, rice, eggs, chicken, and fruits as offerings. Glutinous rice is also made into various kinds of dishes. It is steamed and wrapped in coconut leaves and topped with coconut and palm sugar for exchange at weddings. The glutinous rice is called *ketan* in Bali, and the black variety *injin*. Fermented glutinous rice is known as *tape*, and the liquid therefrom as *berem*. Fermented glutinous rice is usually made for special occasions such as the *Galungan* and *Kuningan* festivals. Balinese farmers also grow glutinous rice for local consumption.

2.2 The Origins of Domesticated Rice

The origins of Asian rice have been long debated amongst scholars, and many theories have been proposed. It is most likely that the places of early domestication occurred around the area of the piedmont zone of Assam, in upper Burma and Thailand, and in Southern China and North Vietnam (Bray 1986:8-9 ; Higham 1984:100).

China

Present archaeological evidence from the earliest stratum of Ho-mu-tu village, in Chekiang Province, China, consists of a large amount of carbonized rice remains including straw, ears, and husks. These have been identified as of *indica* type. The other important discoveries are "hoe" blades, made from the scapulas of large animals, which were suggested to be tillage tools. Some of the wooden handles of the hoes were also found (K.C. Chang 1986:208-212). This evidence suggests that the inhabitants relied heavily on rice cultivation. These discoveries have been radio carbon dated to about 5000 BC. In a nearby site at Luo-jia-jiao, the remains of rice grains were also found, and identified as *sinica* type, and these have also been dated to around 5000 BC (T.T.Chang 1987:66).

Thailand

Non Nok Tha and Ban Chiang, both located on the northeastern plateau of North Thailand, suggest the existence of rice cultivation prior to 2500 BC (Higham *in press*). T.T.Chang (1976) argues that this rice was not domesticated, but an intermediate type between the wild and the weedy forms. This is based on analysis of the irregularity of the glume surface. However, the Ban Chiang rice was probably cultivated even if morphologically still close to the wild form.

Vietnam

In Vietnam, more than fifty small agricultural settlements have been uncovered by archaeologists on the eastern side of the mountains, upstream from the Red River delta. These date to the mid-third millennium BC or earlier, and suggest that the inhabitants were practicing rice farming (Higham 1984:101). The earliest direct evidence of rice in Vietnam derives from two sites of the Bronze Age Phung Nguyen Culture in the Red River valley, and dates to around the mid-second millennium BC (Glover 1985:270).

India

Bray (1986), following Vavilov (1949), states that India is the place where the greatest diversity of domesticated rice is found. Evidence of ancient rice in India derives from the sites of Koldihwa and Mahagara in Uttar Pradesh, where a three-phase sequence has been identified from the Neolithic through Chalcolithic into the

Iron Age. The evidence from the Neolithic levels consists of potsherds impressed with outlines of rice husks. Both domesticated and wild varieties of *Oryza* have been identified. Two dates of 4530 BC \pm 185 BC and 5440 \pm 240 BC are known from Neolithic levels (Glover 1985:271), although as Glover points out, these dates still require confirmation from other sites.

Taiwan

Bellwood (1985), citing Wang (1984) and Li (1983), suggests that the oldest evidence of ancient rice in Taiwan has been discovered at the Chih-shan-yen and K'en-ting sites dated c.3000 -1500 BC, where rice impressions in pottery have been discovered.

Philippines

The earliest evidence of rice in the Philippines comes from the Andarayan site in the Cagayan valley, where a large number of red slipped earthenwares has been uncovered. Carbonised husk and stem fragments of rice are found in the fabric of the earthenware. These sherds have been accelerator radio-carbon dated to 1450 \pm 125 BC (Bryan E.Snow, Richard Shutler Jr., D.E.Nelson, J.S.Vogel, and J.R.Southon 1986:3-11).

2.3 The Introduction of Rice into Indonesia

Carbonised rice and husk fragments have been discovered in Ulu Leang cave in south Sulawesi dated to about 500 AD (Glover 1985). These are the oldest archaeological remains of rice reported so far from Indonesia. Concerning the introduction of rice into Indonesia, Bellwood has argued that Austronesian-speaking people from Taiwan and Luzon, who cultivated rice and foxtail millet, moved towards Sulawesi and eastern Indonesia after 2500 BC. In some equatorial regions rice was reduced to a minor crop, although these groups who moved towards west Indonesia, Malaysia and southern Vietnam continued cultivate it (Bellwood 1985:235-236).

Although much research on the origins of rice has been done by many scholars, the results are still inconclusive. Most researchers, as we have seen, are concerned mainly with the problems of the origins of rice cultivation in Southeast Asia and the major islands of Indonesia, and little research has been done specifically on the

question of ancient rice cultivation in Bali. Although there has been some research on wet-rice cultivation in the Balinese historic period, it constitutes no more than descriptive reports which do not consider the dynamics of how wet-rice cultivation developed. It is hoped that this study will partly redressing this lack of analytical work.

2.4 Irrigation

The concept of irrigation means that water is supplied to the cultivated field, using either simple or complex methods, subject to environmental constraints. The construction of water works such as dams, canals, tunnels, aqueducts and ditches is required to collect and transport water from its sources to the fields. A drainage system is also vital to remove excess water.

Irrigation is essential to wet-rice production. It implies a sufficiency of water supply, water control and drainage. Grist (1959:28) postulates that the most important aspects in wet-rice production are sufficient water supply and its control, rather than the type of soil. Given correct irrigation the crop will grow in a wide range of soils and in different climates.

The actual amount of water needed for the crop depends upon such factors as evaporation, percolation into the soil, seepage and transpiration rate of the plants. These factors are affected by the climate, type of soil, length of irrigation period and method of irrigation, method of land preparation, and method of planting. Surface evaporation and transpiration of the plants are affected by the temperature (the intensity of the light), humidity and wind velocity (ibid, p. 29-30; Valera and Wickham 1984:77-94).

Beside the adequacy of water supply, the quality of water also affects production. This is determined by the provision of mineral nutrients as fertilizer to the crop, and poor quality water may cause crop failure. River water is preferable because it carries silt, and a reasonable quantity of coarse silt has a good effect on the soil (Grist 1959:31).

For the cultivation of wet-rice in hilly areas terracing provides fields which retain runoff, allow through-flow and enable the crop to be grown successfully. Opening

up new agricultural land and building water works and terraces consumes a large amount of labour, which requires communal effort from the villagers. The clearing of new land and the building of water works and terraces are carried out to day in Bali by groups of villagers, who must obtain permission from the village council. A meeting is held to formulate the conditions of participation in the work involved, and usually the members share cost, labour and benefits equally. When the land has been cleared and terraced the use rights are then divided amongst the group. Co-operation between members is very important in the organization and maintenance of the water system as reflected in the co-operative organization of the *subak* itself (Liefcrinck 1969:6-7), which will be the subject of the next two chapter.

Chapter 3

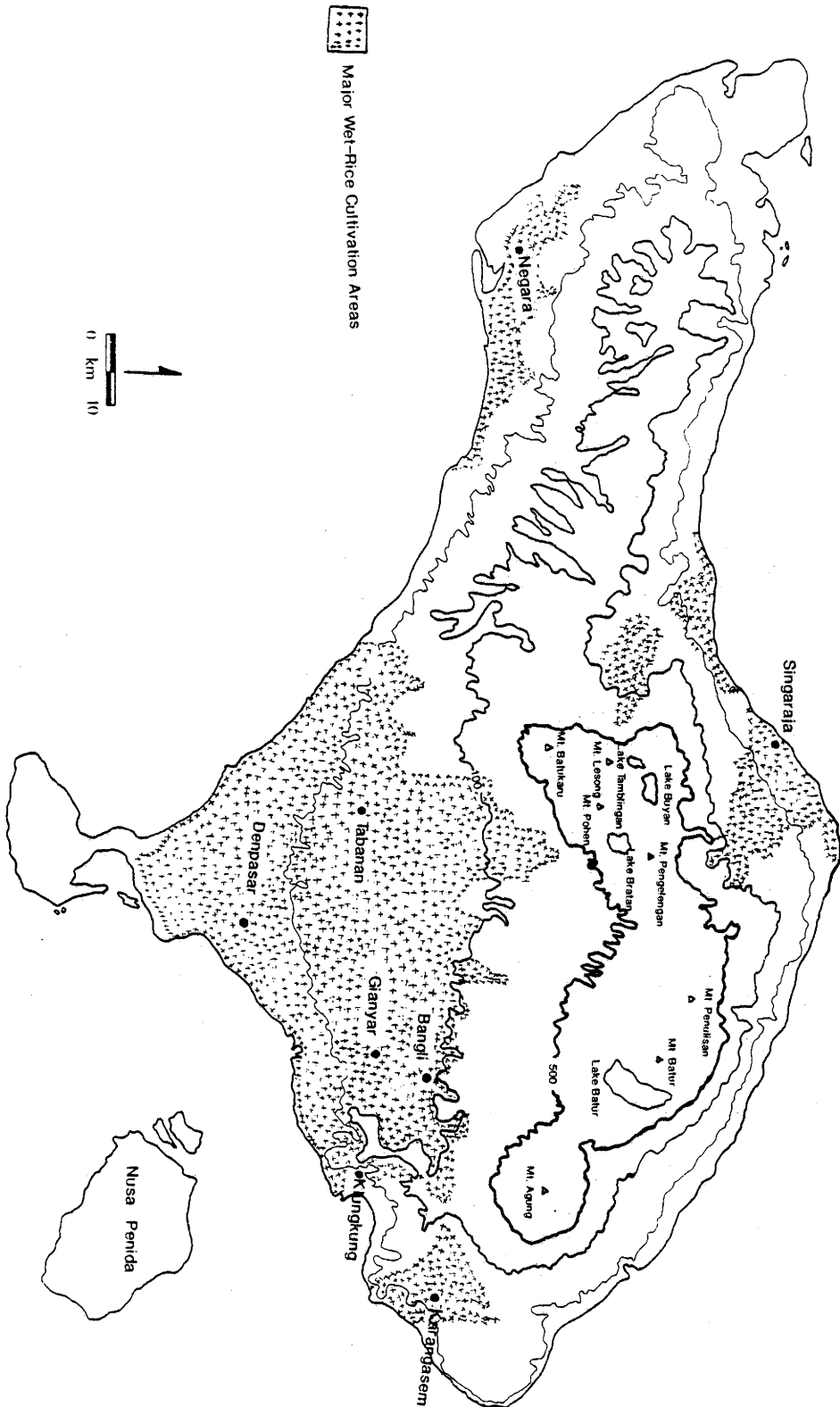
Wet-Rice Production in the Balinese Village (Modern and Colonial-Period)

3.1 The Village

Agriculture, particularly wet-rice production, plays an important role in Balinese society. Its main contribution is the provision of staple food. Although other sectors, such as tourism and fishing produce economic benefits for the society, these remain minor in comparison to agriculture.

A significant proportion of the Balinese population is involved in agriculture. In the 1971 census it was recorded that 66.7% of labour was employed in agriculture, although the 1980 census showed a drop to 50.6% (Griya 1985:1). Almost all of the village community is involved in the production of wet-rice, which requires a high degree of organization and supervision. A great deal of care is needed in the processes of clearing the ground, building terraces and diverting water to irrigate fields. Such labour intensive tasks are carried out through co-operation between village members who rely entirely on themselves. In order to understand the organization of wet-rice production in Balinese society, we have to consider many closely related aspects, such as the topography of the area together with the climate and type of soil; the methods of irrigation and cultivation, the equipment used; the associated religious

Figure 1: Distribution of major areas of rice cultivation in Bali



beliefs, the attitudes of the farmers and, finally, the decision-making processes both for individuals and the group.

The Balinese system of wet-rice production appears to have remained relatively unchanged for about a thousand years, until the recent introduction of mechanization, new high yielding rice varieties, pesticides and fertilizers. Such changes have been adopted purely to improve existing yields; the growing methods, irrigation system, ceremonies and social organization still remain the same. The government may periodically institute changes in agriculture in view of its concern for constant growth of the food supply, human nutrition, urban and rural migration, and related demographic and economic factors.

At this point, it would be useful to outline the major features of a typical Balinese village. Such a description will provide a background to the consequent discussion of the role of wet-rice cultivation in village life. The Balinese village typically consists of groups of houses lining a major road and extending along minor roads or paths crossing this. The houses are grouped according to territorial boundaries to form several wards (*banjar*) within each village. The settlement is surrounded on all sides by rice fields.

The village temples are very important for the community. Goris (1960 : 84-85) explains that when a group of people establish a new *desa* (village), they require three special places: (i) a place called the *Pura Puseh* (temple of origin) to worship the lord of the ground and the deified village founders; situated "higher" than the village (*kaja*); (ii) a grave yard with a *Pura Dalem*, a temple for the *pitara* (the recently purified dead) placed "lower" than the village, and on its seaward side (*kelod*); and (iii) a place for village meetings, called the *Pura Bale Agung* (the temple of the large hall).

The Balinese village is a unit within a complex national administrative system. The island itself is divided into seven *kabupatens* or regencies, and within these are *kecamatan*s (districts) which are each headed by a *camat* (district head). The *kecamatan* consequently consists of many *desas* or villages units.

At present, the village is governed by two types of institution. Firstly there is the *desa adat*, a village council based on the traditional social rules (*awig-awig desa*)

which regulate social life and the performance of social and religious duties. The villagers perform community tasks together to maintain and restore the temples and to perform ceremonies for the well-being of the village. The *desa adat* itself is an autonomous body, and its authority is limited to the village inhabitants. The head of the *adat* is called *bendesa adat*. The *desa adat* controls the *banjar adat*, the traditional council for the separate *banjar* (wards).

The second administrative institution is the *desa dinas*, a post-independence system instituted by the government. The *desa dinas* is headed by a *prebekel*, who is responsible for all government administration at the village level. All government programs, such as birth control, education and agriculture, at village level, are enacted through the *desa dinas*. Under the *desa dinas* are several *banjar dinas*, each headed by *klian dinas*. The *desa adat* are structurally independent of the *desa dinas*, but both relate to each other functionally. The instructions and the programmes from the higher authorities which are related to agriculture will be implemented by the *desa dinas* through the *subak* governing body.

These two types of village level institutions already existed during colonial times. At this time, the *bendesa* and the *prebekel* were the highest officials at village level. The *bendesa* functioned as the head of the *desa adat* while the *prebekel* was responsible to the colonial government in dealing with taxation, statutory labour services, the security of the village, and for transmitting the instructions and programmes of the Colonial administration to the village. The *prebekel* had jurisdiction over the *banjars*, each headed by a *klian banjar*. The villages in colonial times were ranked in districts (*kecamatan*s). The heads of the district were known as *punggawa* and under them were several *mancas*, heading the *onderdistrict* or district subordinates (adat recht bundels, XXIII, 1923 : 387)

3.2 The Subak

The most important social institution in the village economy, concerned with wet-rice production, is the *subak*. Although structurally it is not related to the *desa dinas*, *banjar dinas*, *desa adat* and *banjar adat*, it nevertheless has overlapping functions with these institutions.

The main function of the *subak* is to distribute and control water amongst farmers and to maintain the water system. Some authors describe *subaks* as being complexes of terraced rice fields irrigated by the same major canal or the same branch canal. However, this explanation is too simplistic as it neglects the topography of the area and other social factors. Based on field work in Jembrana, Western Bali, Grader ((1939)1960) argued that "there are various kinds of exceptions to this definition". In his case-study, two complexes of terraced rice fields fed by two rivers formed one *subak*. The two areas actually had no common irrigation interests but since each of them was too insignificant to function effectively by alone, they united to form one irrigation association. This meant that their association could be given broader objectives and that mutual assistance for large-scale activities could be organized more satisfactorily.

Subak members (*kerama subak*) comprise the land-owners or cultivators. The *subak* is structurally an autonomous body which is independent of the village council and government institutions. Membership can include cultivators from different villages, castes and kinship groups, but all the *subak* members have the same rights, duties, and obligations. The *subak* is essentially an egalitarian organization.

Each *subak* is given a name, often the village name, or else a name related to a geographical feature. Its boundaries are usually determined by adjacent *subaks*, villages and geographical features.

Research into the terminology and organizational structures of *subaks* has shown variation throughout Bali, according to the number of members, their geographical separation, the social-economic context, and local tradition.

Of the five *subaks* studied by me, the *Subak Basang Alas* comprises 119 members. 27 of these are called *anggota ngarep* and the rest are called *anggota nyuwinih*. *Anggota ngarep* are members who are responsible for the full-time maintenance of the water system (such as patrolling the water system and day to day maintenance). *Anggota nyuwinih* are not fully responsible for the maintenance of the water works, but they are obligated to work if there is any serious damage. Both categories of members pay the *suwinih* (water payment) and land taxes. The *suwinih* is paid after the harvest. The amount of *suwinih* depends on the amount of seed used; if

a farmer uses 10 kg. of seed he has to contribute 10 kg. of rice to the *subak*. The *anggota ngarep* and the *subak* governing body are entitled to get *suwinih* after every harvest. Half of the total *suwinih* in every harvest is divided amongst them and half is for the *subak* treasury. The *anggota nyuwinih* do not have the right to share in this *suwinih* division.

Subak Embukan Karangasem has a different organization. Members who cultivate less than one *catu* ($10m^2$) of land are not obligated to be responsible for the maintenance of the water systems. They have to pay *suwinih* in the amount of one *catu* of rice (around two and a half kg). Members who cultivate more than $10m^2$ of land are responsible for maintenance. In *subak* Gunung all members are obligated to become active in maintenance, because the topography of the area (steep slopes) creates much more work.

The administrative structure of the *subak* in Bali (see figure 2) consists of the *klian* or *pekaseh*, that is the head of the *subak*, assisted by several *kesinomans* or *juru arahs*, and sometimes is completed by a *penyarikan* (secretary), and a *sedahan daging* (treasurer). If the *subak* is big, it is generally divided into smaller divisions, to lighten the burden on the *klian* or *pekaseh*. One *subak* can consist of a number of *tempeks*, maybe from three to fifteen. The term *tempek* is used for those smaller divisions in Bangli, Gianyar, Klungkung and Karangasem provinces; but *munduk* is used in Badung province; *banjaran* in Buleleng province; and *arahan* in Jembrana province.

Each *tempek* is headed by a *klian tempek*, who in some areas might be known as *klian munduk* or *klian banjaran*. The *klian tempek* assists the *pekaseh* in organizing the day-to-day works at *tempek* level. The *klian tempek* is also assisted by a *penyarikan*, a *sedahan daging* and several *saya arahs* or *kesinomans* (messengers), who work together under him for maintenance and supervision of irrigation works and the common property. The *klian tempek* assists in the collection of land taxes and in co-ordination work with government officials.

The simplest *subak* structure includes a *pekaseh*, a *wakil pekaseh* (the assistant head of the *subak*), and *kerama subak* (*subak* members). The *subak* has a small number of *subak* members, usually not more than twenty five, and the land holding

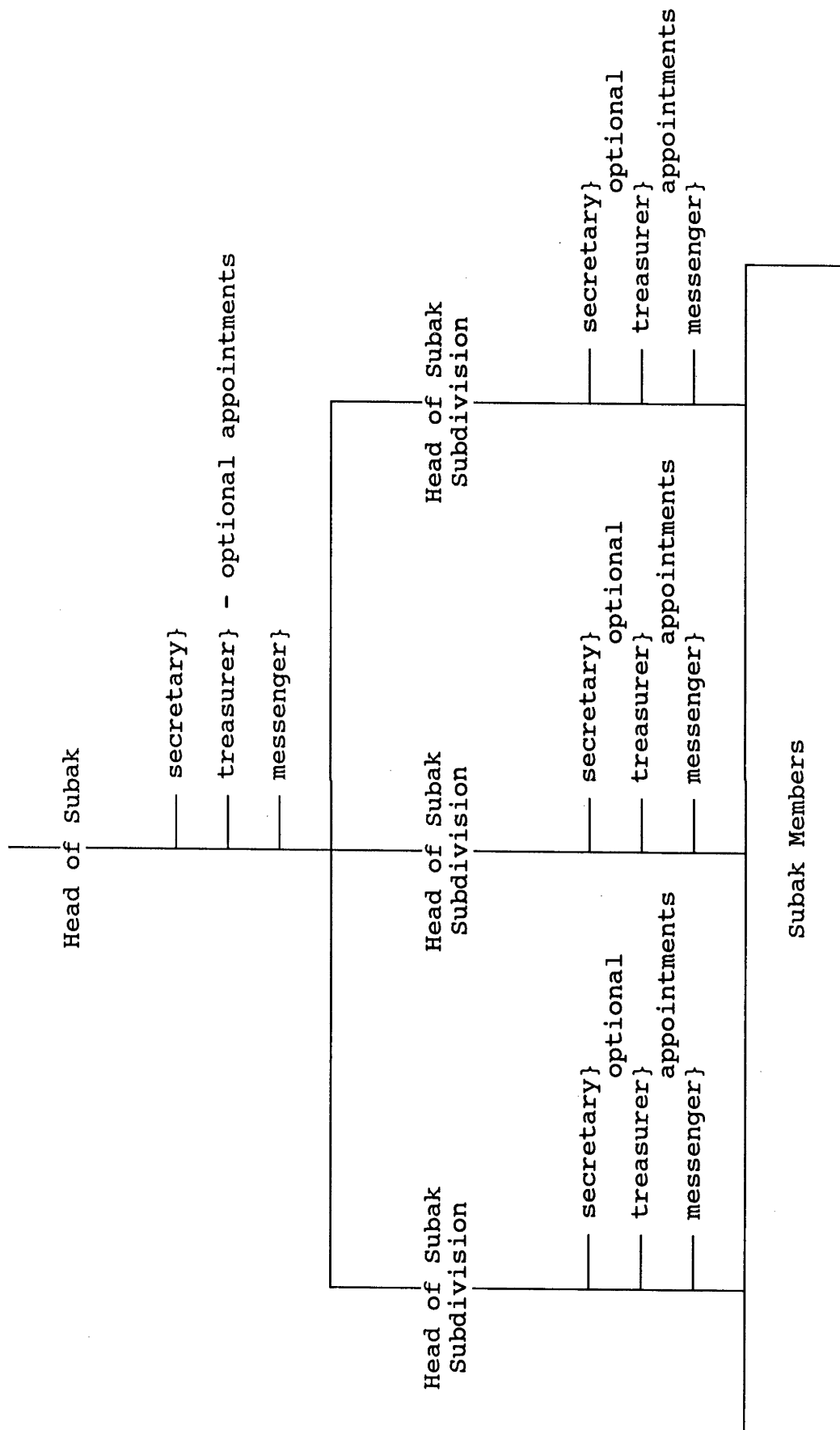


Figure 2: The administrative structure of the Balinese Subak

of each is relatively small.

Figure 3 shows the organisational structure of *subak* Basang Alas. The head of this *subak* is known as a *kliang*. His duties include organisation of meetings and ceremonies, and general *subak* business. There is also a *pekaseh* who is responsible for maintenance of water-works. This differs somewhat from the more usual *subak* organization structure, where the head is called either a *klian* or *pekaseh*, and has responsibility for all aspects of *subak* administration, including irrigation matters. The *keliang* and the *pekaseh* are assisted by a *penyarikan*, who is responsible for the *subak's* administration and makes notes of *subak* activities. A *sedahan daging*, treasurer, is responsible for *subak* funds; and a *saya arah* (messenger) passes messages to the members concerning the issues which have to be disseminated. The number of messengers in a *subak* organization depends upon the number of members and the location of their dwellings. If the dwellings are widespread, then a large number is needed. They are usually chosen from *subak* members in rotation, and serve as temporary assistants of the *pekaseh*. At *subak* Basang Alas, Karangasem, the messengers perform the duty for a month at a time (i.e. a thirty-five day Balinese month), and are freed from their usual obligations during this period. The messengers at *subak* Basang Alas are drawn only from the *subak ngarep* members (active members). If they fail to perform their duty, they are fined.

The *pekaseh* is elected by the members of the *subak*. According to *subak* rules an election must be held every five years, but in some cases this is not followed. If the performance of the *pekaseh* is satisfactory to the members and he is capable of continuing to perform his duties, the election will not be held. If the head of the *subak* is unable to perform his duty because of age and sickness, then he will resign. Most of the heads of *subaks* hold office for more than five years. The *pekaseh* is chosen from amongst the members as a person who has knowledge and competence in rice farming and who is literate, either in Balinese or Indonesian, loyal, hard working and respected by the members for his personal qualities. He also has to be at least twenty-one years old. He is responsible for co-ordinating and supervising all the work of the rice fields, such as distributing the irrigation water, planting, harvesting, ceremonies, patrolling the *subak's* conduits and dams, and maintenance

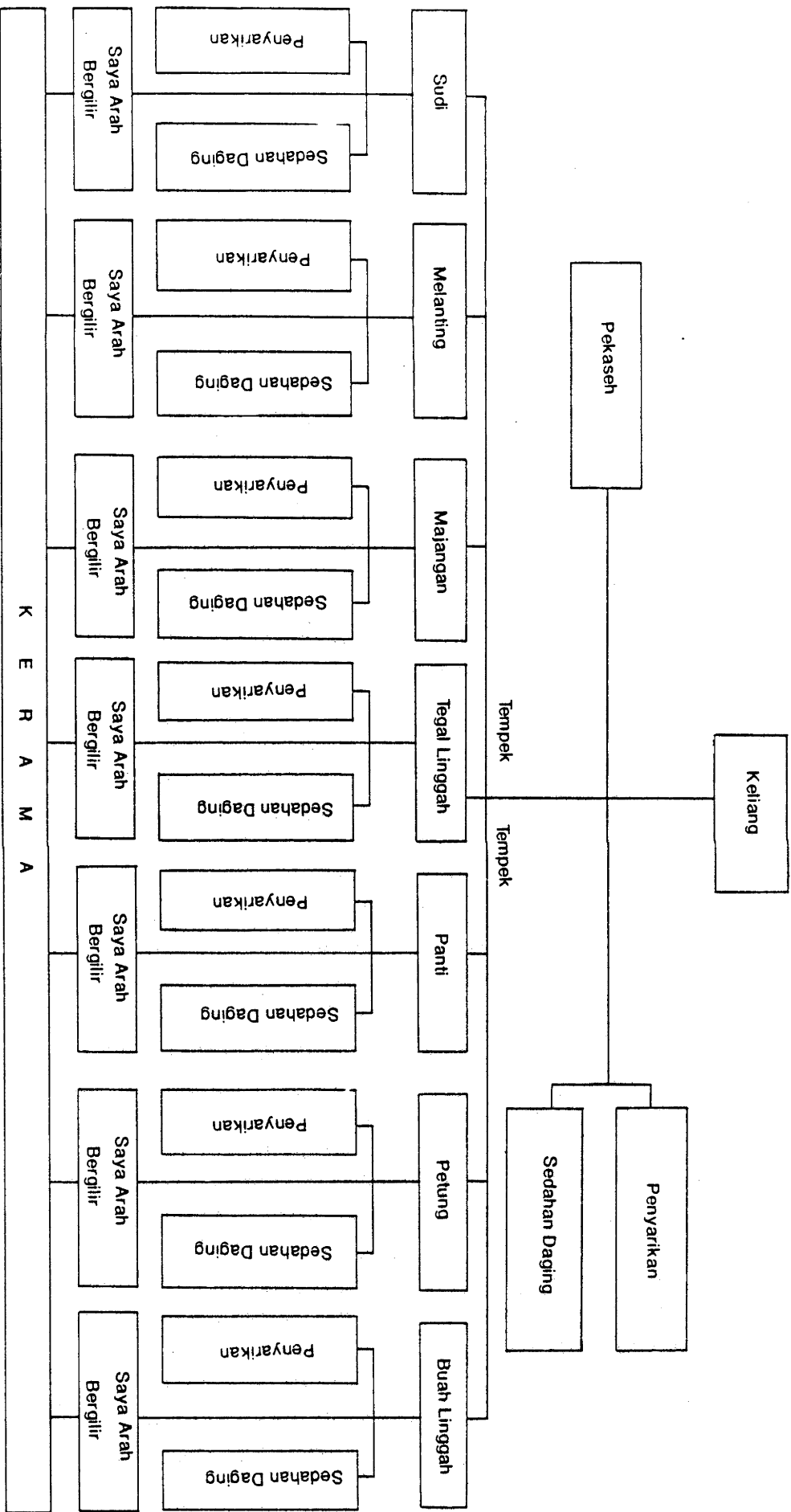


Figure 3: The organisational structure of subak Basang Alas

of water installations. He also acts as a judge if there is conflict between members, but if the problem cannot be solved at *subak* level then he refers it to a higher authority, such as the *sedahan tembuku* or the *sedahan agung*. The head of the *subak* leads the monthly meeting, where there are discussions of agricultural issues and of new programmes, which are usually initiated by higher authorities such as the Minister of Agriculture.

The *pekaseh*, if he does not have an assistant, will personally notify the *kelian tempeks* with instructions to be distributed, for instance when collective work has to be done. The *klian tempek* will then pass on these instructions to their members through their own *sayas* (messengers).

If a particular *subak* structure does not include a *penyarikan*, a *sedahan daging*, and *sayas*, then the *klian* has to perform all these duties himself. In some *subaks* the *klian* or *pekaseh* has a double task as the head of his own *tempek* as well, as in *subak* Gunung, Ababi, Karangasem. This situation arises because the number of members is relatively small, and it is hard to find someone who is willing to fill this post, to work hard, and who is loyal and dedicated.

The *klian subak* has very heavy duties for which he is not paid, although some *klians* get the right to a double share of irrigation water or some similar advantage. The *klian subak* in colonial times received a small percentage of the tax levied on the *subak*, because he helped the *sedahan* to collect the tax (Lieftrinck 1969:10). At *subak* Basang Alas, the *klian* or the governing body does not get the right to a double share of water but they receive other privileges; such as rice from *suwinih*. *Subak* Abang extends privileges to its governing body, whose members are free from collective work responsibilities and do not have to pay water payment if their holding is less than three *catus* (30m by 30m). They only pay the water payment for excess holdings.

3.3 The sedahan

The *sedahan agung* is an official intermediary between the *subak* and the government. One is appointed to each of the eight *kabupatens* (regencies) in Bali and is responsible to the Department of Agriculture at province level in Denpasar, the capital city of

Bali. Each *sedahan agung* in turn is assisted by several lower-ranking *sedahans* (cf. next page) in collecting tax and overseeing the irrigation work. The *sedahan tembuku* or *sedahan yeh* is the official who is directly responsible for overseeing the irrigation. For instance, if an irrigation project has to be done, such as repairing or constructing a dam used by one or more *subaks*, then the *sedahan agung* and *sedahan tembuku* supervise and guide the work. They are also involved in the arrangements for the irrigation rotation between *subaks* if the available water is not sufficient. Grader (1960:287) observed that the *sedahan agung* was also responsible, together with the *desa* administration, in organizing statutory labour in colonial times.

The functions of the *sedahan agung* and the lesser *sedahan* are very similar to those of their predecessors in the traditional Balinese kingdoms. Geertz (1980:67-68) notes that in the pre-colonial period, in what he calls the 19th century states in Bali, the *sedahan gede* was responsible for rent and tax collection for the lords. He was usually a relative of the noble house, and was assisted by several *sedahans* who were also closely related to the noble house. They got certain privileges for their duties.

The *sedahan agung* in colonial times was the head of the regional land rent office, and he was assisted by four other *sedahans*, lower officials, two for the *sawah* (wet-rice fields), and two for the *tegal* (dry fields). One of the former was the *sedahan tembuku* in charge of the irrigation work, supervising the allocation of the irrigation water. The *sedahan agung* was a liaison official between the Dutch authority and the *subaks* (Grader 1960:287).

In southern Bali, the agriculture officials who were known as *penyarikan gede*, *sedahan gede*, and *kliang gede* (the Balinese lords' officials during the time of principalities) were all given the title *sedahan agung* by the Dutch colonial authorities. Since then the *sedahan agung* has been the higher official who dealt with agriculture at the regional level. The *sedahan agung* was appointed by the *residen* (resident) through the agreement of the heads of *subaks* (staatblad. V. NJ. 1928, no 260).

If there is a problem or conflict amongst *subak* members and the *pekaseh* that cannot be solved, then the *pekaseh* submits that problem to the *sedahan* or *sedahan agung*. The monthly regular meeting of the several *sedahan tembukus* in colonial

times was held at the regional centre and presided over by the *sedahan agung*. All issues relating to agriculture can be discussed at these meetings, and at the same time, collection of taxes is arranged (Lieftrinck 1969:12). Nowadays these meeting are held once every three months in Karangasem and are attended by the *sedahan agung*, the *sedahans* and the *pekasehs*.

3.4 Taxation

Present day land taxes under the Indonesian government are known as Iuran Pendapatan Daerah (Ipeda), which means "contribution to the revenues of the district". In the colonial period land taxes, known as "landrente", were introduced in 1922 (V.E. Korn 1932:327).

Present-day land taxes are levied according to a system of land types based on the topography of the land, proximity to main roads and water resources, and to the fertility of the soil (8 soil classes are distinguished for this purpose); and of course also according to extent of holdings. These factors all affect the productivity of land hence the amount of taxation which can reasonably be levied.

Land types and soil classes are determined by the Dinas Pengenaan Ipeda (Taxation Office) in Denpasar. The soil classification system was introduced by the Dutch in 1934. Guidelines and general instructions for the collection of land taxes are set by the head office in Denpasar, and branch offices at regency (*kabupaten*) level examine the land in their area to determine and report on the actual land types and soil classes of the local holdings.

The land taxes are collected once in a year by a government official known as *sedahan* or *penglurah* in Karangasem. The collection usually takes place at a *banjar* or in the office of the village head. The schedule for land tax collection originates with the *sedahan*, who informs the *camat* (district head), then passes the schedule on to the *prebekel* (village head), and so on down the hierarchy to the *pekaseh* (head of *subak*) and hence to the *klian tempek* (head of *subak* sub-division) and to the actual farmers whose land is part of the *tempek*. A copy of the schedule is kept on file in the Dinas Pendapatan Daerah Dati II (*sedahan agung* office). As in colonial times, the *sedahan* is assisted in tax collection duties by *subak* officials, the *pekaseh*, and their

subordinate *klian tempeks*; these later officials do not received any remuneration from the government for this.

3.5 The Subak Funds

The *subak* funds are raised from the water payment (*suwinih*), fines, government donations and by contributions from the members, which are collected at every monthly meeting. For instance, in *subak* Gunung, Ababi, Karangasem, each member contributes twenty-five rupiahs at every monthly meeting for the *subak* treasury. This is mainly used for building and maintaining the irrigation works, and for ceremonies. In some *subaks*, funds are lent out at interest, with the rate varying from three to five percent per month. The *subak* members are given the first priority for such loans and usually their land serves as security for the payment of the interest and the total repayment of the loan. At *Subak* Basang Alas the interest is three percent per month, the loans depend on the security and the available money in the *subak* treasury.

3.6 Subak Meetings

Subak hold regular meetings once every Balinese month (35 days) on a specified day. *Subak* Basang Alas held the meeting every *Anggara kliwon* (Tuesday *Kliwon*) in the morning, wearing traditional costume (*sarung* and *saput*, a scarf wrapped around the waist). These meetings are preceded by the making of offerings called *beras kuning*, which are prepared by the two members whose turn it is to perform the duties of *saya* for the month and to provide betel nut and cigarettes.

Other meetings are occasionally held if there are important things to discuss. To call a meeting on the instruction of the *klian* the *saya* will strike the *kulkul* (a wooden gong) as a signal to the members. Attendance at the meeting is compulsory for all members and those who fail to attend are fined, as are those who arrive late. A fine of 250 rupiahs is imposed on members who fail to attend for no good reason (who are called *mamandal*). No fine is incurred for non-attendance due to illness or death in the member's family, this being known as *nyaluk*. Less cogent

excuses, such as having to attend ceremonies elsewhere, or visiting sick relatives (known as *malalungan*), attract a reduced fine of 100 rupiahs. Latecomers (*sep*) to *subak* meetings are fined 25 rupiahs if all the water has run out through the hole in the bottom of a coconut shell "timer" (*janggi*). The fine escalates to 125 rupiahs if the meeting is already pass half-way through, and this is known as *seleman*. Unpaid fines can result in confiscation of lands by the village. Defaulters are prevented from cultivating their *sawah* until the fines are paid. Such events are rare at *subak* Basang Alas.

In these meetings the matters discussed include such items as times for planting, harvesting, and ceremonies that must be carried out. In addition the schedule for spraying the insecticides and fertilizer, controlling the water system, and maintaining and building the irrigation work is agreed upon. Here the fines are paid and the instructions from the higher authority are passed on the *subak* members.

3.7 Subak Regulations

Grader (1960:278-279) observed there are two types of *subak* regulations: *sima* and *awig-awig*. *Sima* regulations were issued by a former ruler. Copies of the *sima* or *kerta sima* are kept by the *sedahan agung*, the *sedahan tembuku*, the *pekaseh*, or an elder of the village council. *Awig-awig* regulations are orally transferred within the *subak* itself. Grader further draws attention to an important point concerning *sima*: the *sima* regulation imposes a penalty for any breaking of the *awig-awig* regulations.

Generally the *sima* or *kertasima subak* regulations first begin by mentioning the newly formed *subak*, and defining the geographical features. The regulations apply to all *subak* members irrespective of their caste or class in society. They strongly recommend that all members have to keep the peace among themselves and with other villagers with whom they share irrigation water, and as farmers they have to work hard. The *klian* has to maintain a good relationship with the village council and he is responsible for organizing the ceremonies related to wet-rice cultivation. He is also responsible for solving problems within the *subak* and maintaining the peace amongst its members (van Setten van der Meer 1979:44-45). In the regulations further obligations and duties are to be fulfilled by the governing

body and the *subak* members; taxation; water payments; and fines for offences such as stealing water, rice or seedlings, or the destruction of water works and rice fields by humans or animals.

Nowadays some *subaks* write the *awig-awig* regulations down in a small book, in Roman script but still in the Balinese language. For instance, *subak* Basang Alas and *subak* Abang wrote their *awig-awig*, encouraged by government officials. *Subak* Basang Alas wrote down its *awig-awig* regulations in January 1987.

3.8 The Sekaa

Beside the *subak*, another group called a *sekaa* also takes part in wet-rice production activities. The *Sekaa* is a voluntary association of people who have the same interest and purpose. Their activities can be related to economic, social and religious matters. *Sekaa* can be drawn from different villages as long as they have the same interest.

Each *sekaa* has its own rules, usually not written but based on agreement. The association can be temporary or permanent. These associations have their own leaders who organize activities and take the initiative. Those *sekaa* which have economic objectives work for wages, such as *sekaa manyi* (harvest association); *sekaa mamula* (association for planting); *sekaa yeh*, an association for controlling water (Lieftrinck 1969:4; Grader 1960:283; Geertz 1979:74). According to Grader (ibid.) *sekaas* are communities formed to lend mutual help amongst their members, and they get paid if they work for third parties.

At *subak* Basang Alas, Karangasem, the *sekaa mamula* and *sekaa manyi* are formed by one *dadia*, the Balinese endogamous patrilineal kin-group. They work for wages, and the money contributed to the *dadia*'s treasury is used to perform ceremonies and restore the *dadia*'s temple.

3.9 The Maintenance of the Irrigation System

The maintenance of the irrigation systems in a *subak* depends greatly upon the scale and the construction of the works. The capability of the *subak* to afford the

construction of the system depends upon the size of its financial reserves. Some *subak* may have a permanent system which demonstrates the expenditure of great effort in the use of concrete and dressed stone, whereas other *subaks* might have a relatively simple construction made from simple materials, such as earthen canals, coconut trunks, logs and bamboos. Hardly any of the *subaks* have a water system made entirely with permanent materials, because a great amount of capital investment is needed, which is impossible for most farmers to afford.

In some *subaks*, where most or all of the system is constructed simply, the heavy floods during the rainy season often cause silting by mud and sand, or even more serious damage. During the rainy season more care is needed to prevent such damage and an extensive use of labour is required to maintain the water system.

Before 1969, *subak* Basang Alas had a simple water system. The dams were constructed from coconut trunks laid across the river to raise the water to a certain level; canals were simply trenches dug in the ground, the water dividers were made from coconut trunks and the water inlet to the *sawah* was made from bamboo pipes. Since 1969 some permanent water works have been built; such as three dams (*empelan* Tukad Buka, *empelan* Tukad Pangi, and *empelan* Tukad Ample). The main canal is 675 m in length and cement-lined. The rest of the system is constructed simply, including the four water dividers two of the dams (*empelan* Buah Linggah and *empelan* Petung which are constructed by stones held together in bamboo baskets laid across the river to raise the water level), and the secondary and tertiary canals, which are still of earth.

The construction of some permanent water works at *subak* Basang Alas has lightened the burdens of the members, especially during the rainy season. Permanent work also result in a better-controlled water system as the permanent dams are constructed with gates, so that the sudden flow of excess water may be rapidly diverted.

The finances for constructing water works are usually derived from the *subak* treasury. If this is not sufficient for all the constructions, then each *subak* member has to contribute a certain amount of money which is determined through agreement amongst all members. The wealthy farmers might donate extra money, or

materials such as cement, stones and sand. Some *subaks* might get donations from the government and, in some cases, the government funds the construction of dams, the main canal and water dividers as part of its agricultural projects. Although these projects are funded by the government, the maintenance of the water system is mainly carried out by the *subak* members.

If work has to be done to repair damage, such as leaks, collapses or blockages due to silting and erosion, then the *klian* gives an instruction to the *saya* to strike the *kulkul* to signal that the work has to be done immediately. This incidental work is carried out collectively by all *subak* members. The absence or late arrival of a member to join the work incurs a fine. At *subak* Basang Alas, members are fined for non-attendance at prescribed repair or reconstruction work on the irrigation system. A first offender is fined 250 rupiahs then 500 rupiahs and 2500 rupiahs for a third offense. The land of fine-defaulters can be seized by the village and only returned to the offenders when the fines are paid. Besides this incidental work, there is also regular collective work to repair the water system, the road to the *subak* and the *subak* temples. This regular work is carried out every one or two months, as needed.

A regular inspection of the water works is also needed to prevent water abuses, such as theft, and damage to the water works and rice fields. A team is formed to patrol the irrigation works and rice fields. This consists of members chosen in rotation and the patrolling system is known as *matelik* in some *subaks*. Each *subak* has its own policy for organizing its patrol system. A team might have this duty for ten days to a month. The number of people in a team varies depending upon the number of *subak* members, and the scale of the system.

3.10 Water Technology

The technology of the irrigation system is simply-constructed and cheap, but it is easily damaged or eroded by strong floods and it requires intensive labour to maintain it. The complexity of the water system varies from *subak* to *subak* depending upon their respective sizes and topographical locations.

The terraced rice fields are generally irrigated by damming one or more rivers. In some cases they are also irrigated with additional water supplies from springs.

Both situations can be seen at *subak* Embukan, Karangasem, where irrigation water is mainly supplied by a dam, continuously, although the levels are lower during the dry season between April and September.

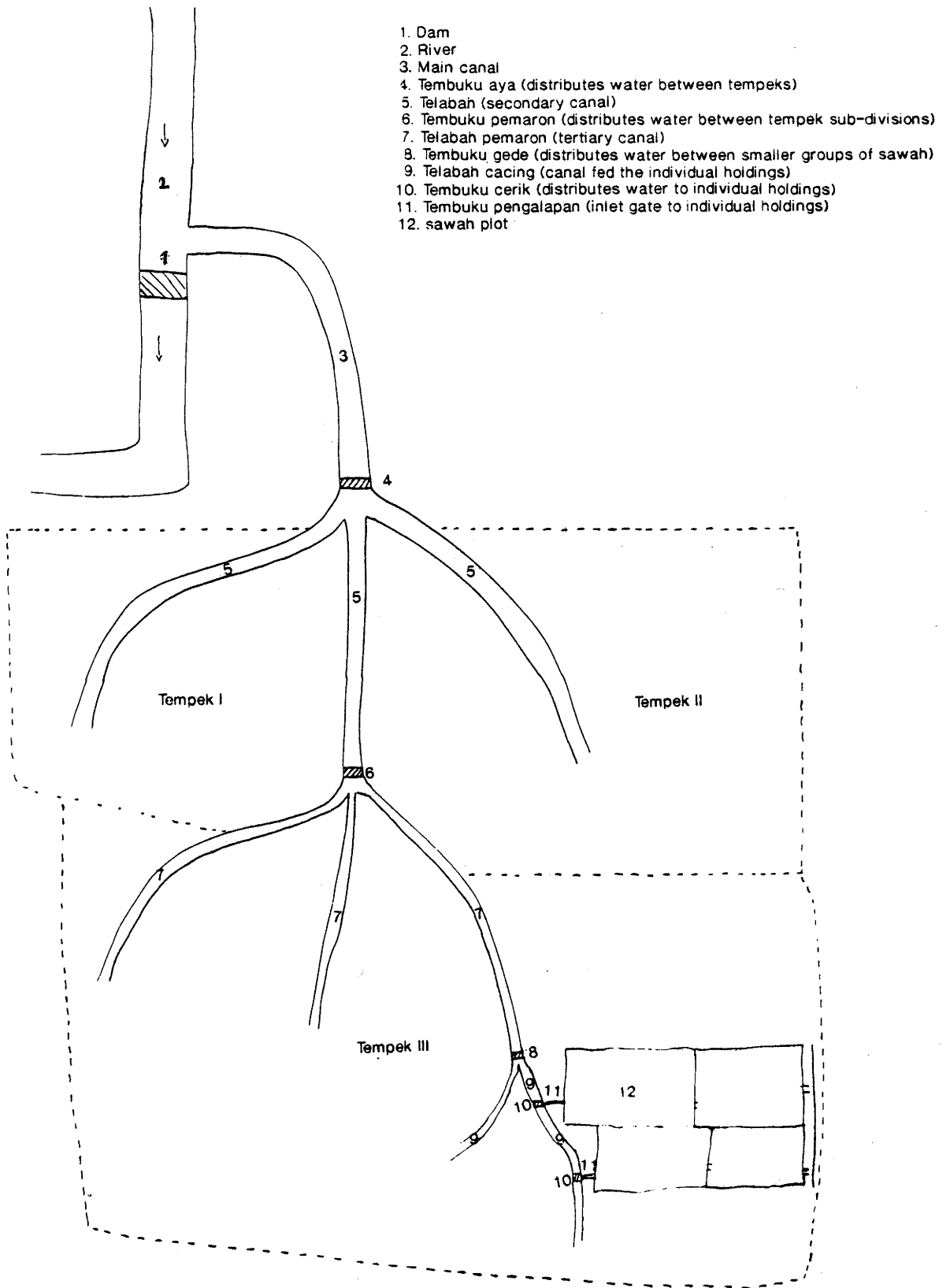
A single dam may be owned by one *subak* or shared by more than one depending upon the water availability or the amount of irrigable land. In some cases, the dam is situated far upslope from the terraces, and a long main canal has to be constructed to bring water down to the *subak's* fields. Tunnels and aqueducts are constructed to suit these conditions. Smaller dams, canals, and weirs divide and redivide the rivers, being systematically adjusted by the *subak* to ensure that the more remote fields receive an adequate water supply.

The details of the system described here depend a great deal on the topography of the area. (See figure 4). A dam (*empelan*) across a natural river is used to feed a large canal, *telabah gede*, which serves a large area of terraced rice fields, which are collectively owned by *subak* members. Each *telabah gede* has one primary water divider (*tembuku aya*) which allows a flow of water into smaller canals (*telabah*) which feed the subdivisions of the *subak* (*tempeks*). The *tembuku aya* is nowadays generally a vertical wooden or metal board slotted into a concrete or metal base. Some of the *tembuku aya* are still made from coconut trunks, a feature also seen during colonial times. As Lieftrinck (1886) describes:

"The *tembuku* is a beam placed across the conduit on a supporting wall at each point where the water is to be diverted. Two large rectangular notches, separated by the middle section of the beam, are cut to the same depth but with differing widths of which the ratio corresponds to the proportional allocation of water. Often additional lengths of wood are placed on top of the unnotched sections of the *tembuku* so that the ratio of diversion will remain constant even if the level of the water rises above the *tembuku*. It is of course, essential that the notches should be smooth and even and that the *tembuku* is exactly horizontal, this being easily verified with *geganjing* (water level) or by checking whether the depth of the water is the same over the bases of both apertures."

The use of a simple water level is employed with remarkable skill by the Balinese.

Figure 4: Water reticulation system



The secondary canals (*telabah*) are further divided by secondary water dividers (*tembuku pamaran*), similar in construction but usually smaller in size to the *tembuku aya*. The smaller canals *telabah pamaran* branching out from these secondary water dividers then conduct the water to tertiary dividers (*tembuku gede*), from which radiate yet smaller channels called *telabah cacing*. These channels are then tapped by individual holdings using simple inlet gates (*tambuku cerik*) and inlet pipes or ditches (*tambuku pengalapan*). These inlets are generally constructed from bamboo or simply of earth/clay, and must be placed at the top of each holding. Excess water from each individual holding is then returned to the *telabah cacing* through an outlet at its bottom. Water does not drain directly from one holding to another. Water from the *subak* is not necessarily returned to the river from which it came but may be directed to other rivers to feed other *subaks* down stream.

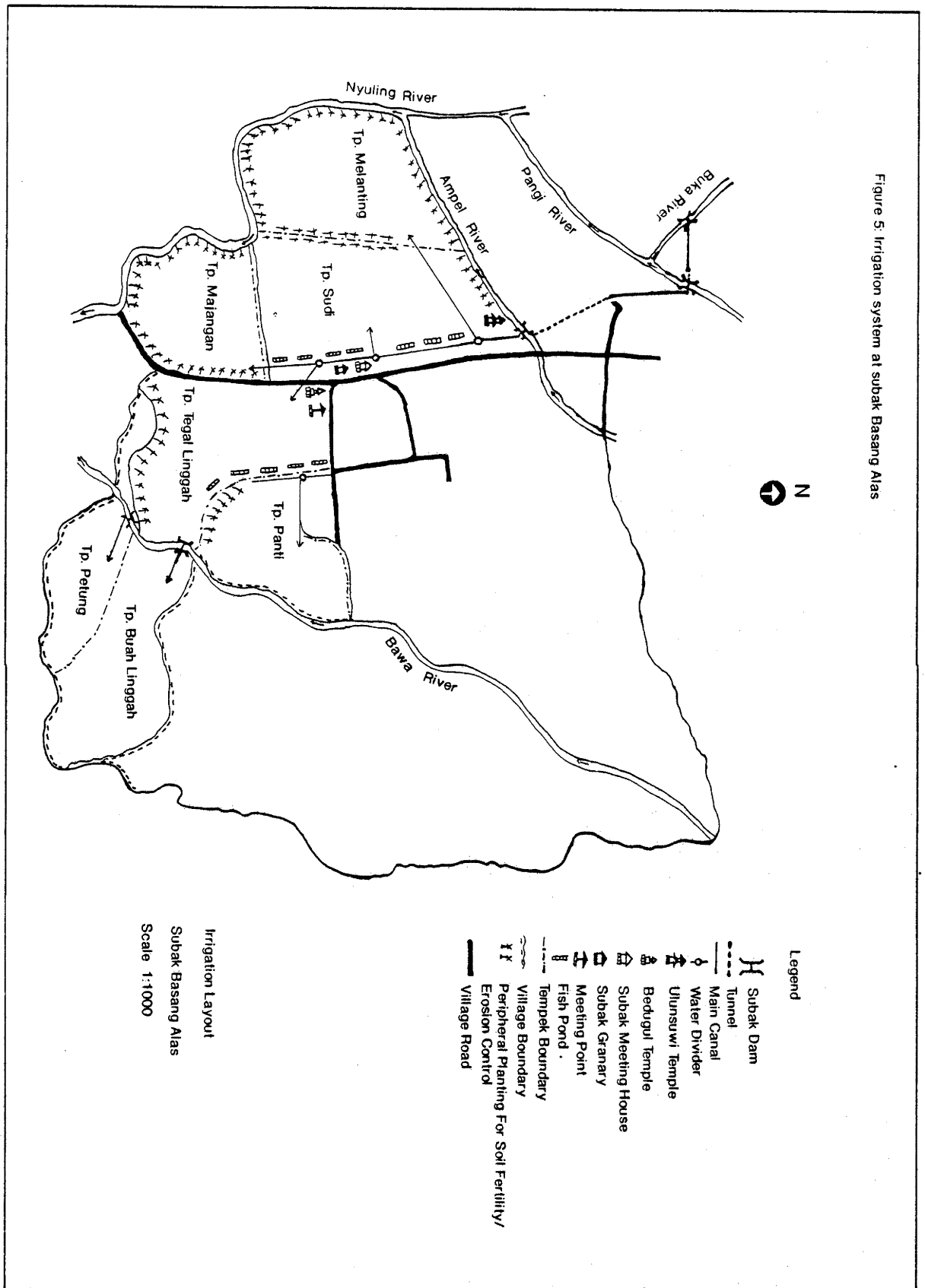
In some cases more than one *subak* shares, under mutual agreement, one dam or one major canal; in other cases, one *subak* might have a more complex water system, owning several dams and canal systems. This is because of topography and available water resources. One example is *subak Basang Alas*, Karangasem, which comprises seven sub-divisions (*tempeks*). Five *tempeks* are irrigated by a main canal which runs down from a dam situated on the Ampel river. During the dry season, the Ampel river dries up, but the dam is fed by two other dams upslope on the Buka and Pangi rivers (these rivers still have the capacity to fill the dams during the dry season). Two further *tempeks* are fed by the main canal and by damming the Bawa river on which two dams are constructed, each feeding directly into one *tempek*.

It is not known when and in what order the dam, canals and tunnels of *subak Basang Alas* were built. The head of the *subak* and the head of the village and other farmers were questioned but no one could give any explanation about the early history of the system. However, some assumptions can be made about how the irrigation system was developed.

Referring to figure 5, there are two advantages in having the dams of the three rivers connected; (1) to increase the total water capacity; (2) to overcome seasonal variations in the flow of the Ampel river.

The dam on the Pangi river is 25 m higher up and 845 m away from the dam

Figure 5. Irrigation system at subak Basang Alas



The dam on the Pangi river is 25 m higher up and 845 m away from the dam on the Ampel river. The last 500 m of the canal system between these two dams is via a tunnel which would have been very expensive and difficult to build. A special road was built for the construction and maintenance of this tunnel by the *subak*. The dam on the Pangi river is also fed from another dam on the Buka river, which is 5 m higher and 201 m away from the Pangi river. The last 51 m of this canal also flows via a tunnel.

The damming of the Pangi river might have been done first, and then when it was found that the water capacity was not sufficient due to expansion of the rice fields, the dam was fed by creating another dam on the Buka river, higher up, and joining the two by another canal and a tunnel. From a dam on the Pangi river another canal and a tunnel were constructed to bring water to the Ampel dam, which is the closest dam to the *subak's* terraces. The additional water capacity of the extra dam must have been necessary at some stage because a lot of work would have been needed to build these extra dams, canals, and tunnels. The Bawa river fed the other two sub-divisions because that river is the closest and most convenient source of water for them. However it is not sufficient on its own to irrigate the two *tempeks* below its two dams. The major canal in the system runs into the Bawa river to increase the water supply to these dams to an adequate level.

In general, the rice cultivators may have the option of supplying certain dams with additional water from other dams located higher up on the same stream or on adjacent streams if the water capacity from the existing dams does not prove to be sufficient. Therefore, in this way a rice irrigation system may evolve in an 'ad-hoc' way.

3.11 Water distribution

Water distribution amongst *subak* members in Bali relies more on negotiation and consensus than on an exact measurement of volume . As Lieftrinck (1886 (1969)) writes :

“ The Balinese do not have a standard unit of water measurement, nor any device for registering the volume of water flowing past a given point so it is impossible for them to divert a given quantity from the conduits. Measurement in quantity is usually unimportant as the main consideration is to contrive the distribution of the available water in conformity with the proportional allocation fixed, prior to the construction of the conduit for the *subak* supplied from the same river, and after the construction of the conduit for the various *sawah* holdings in the *subak*.”

If several *subaks* are fed by a single dam, then the *sedahan tembuku*, an official under the *sedahan agung*, supervises the allocation of the total water supply for each *subak*. This allocation is fixed by traditional regulations. Some of the *subak* regulations set out what proportion of the river water is distributed to the different dams on the given river, or when one dam is shared by more than one *subak*, what proportion of the dam's output is directed to each (Liefcrinck 1969; Geertz 1979).

From a dam, a main canal runs down the slope. When the water reaches the *subak* fields, it is diverted into individual fields. Consensus determines the division of water amongst the members within one *subak*. The installations of the *tembuku pamaroan*, (which diverts water to the *subak* sub-divisions), and the *tembuku pangalapan*, (which diverts water to the individual holdings), occur under the supervision of the *pekaseh*.

Generally *subaks* divide their irrigation water in one of two ways. Firstly, the water division can be based on the number of members, where the water will be divided equally amongst these members irrespective of the size of individual holdings. Each cultivator has the same allocation of water, and also has the same obligations. This type of allocation system occurs where the number of *subak* members is small, the water available is sufficient for all, and the size of individual holdings is relatively small. The measure of water, generally called a *tektek*, does not have an exact volume. The use of terms for *tektek* vary throughout Bali, some other examples being *kecoran*, *tenah*, *tuluk*, *catu*, and *colek* (Geertz 1979; Sutjipta 1987).

An example of this system is that if a *subak* comprises twenty members, then the water will be divided into twenty *tekteks*. If it also consists of two terrace complexes, consisting of twelve and eight members, then the aperture of the *tembuku aya* will

be divided in the ratio 12:8. One complex will get eight *tekteks* and the other will get twelve *tekteks*. If a complex with eight *tekteks* of water allocation is further divided into smaller complexes, for example, three and five, then the complexes will get three and five *tekteks* of water allocation each. In some cases this system sometimes does not work properly because it is too imprecise. To overcome this problem some *subaks* might have a wider aperture upstream than downstream. The reason is that the rice fields downstream get overflow from the rice fields upstream. Some *subaks* might apply the reverse system, the opening upstream being narrower than that downstream, because the flow rate of the water downstream is smaller, due to percolation, seepage and evaporation.

Liefrinck (1969:59) finds that this system of water division is not precise. If the water is divided into two equal allocations, then the result is satisfactory, but if the water is divided into unequal proportions, the result is not precise. This is because the rate of the water flow in the middle of the canal is greater than on the sides; a central aperture, two or three times larger than a side one, will divert more than two or three times the volume of water passing through the smaller aperture. The greater the rate of flow the greater the inaccuracy. Liefrinck further describes how to overcome this problem. The Balinese set the *tembuku* horizontally in the canal by widening and deepening and strengthening both sides of the canal. Hence the rate of flow is equalized through both apertures in the *tembuku*. This is because the current is broken and the water comes almost to rest in the widened section of the canal.

A second system of water distribution is based on the size of each individual holding; the larger the holding, the greater the quantity of water it is entitled to, and the higher the water payment made.

Subak Basang Alas, Karangasem, divides its irrigation water according to the size of individual holdings. Traditional measurements are made, using the diameter of various standard-size bamboo poles as standards of measurement to the individual holdings. The measurement called *sikut iga-iga bale gede* is the amount of water that passes through a pipe 6 cm in diameter; *sikut iga-iga saka enam* corresponds to a diameter of 3 cm, and *sikut iga-iga saka pat* corresponds to 1.5 cm. The

by 30 m); and *sikut iga-iga saka pat* is used to irrigate $1\frac{1}{2}$ *catus* (15 m by 15 m). The ratio is 1 cm of pipe diameter to each 10 meters of plot (linear measure). If the farmer has a holding of less than 10 m by 10 m or more than 60 m by 60 m the diameter of the pipe will be calculated using the ratio above under the supervision of the *pekaseh* (the head of *subak*). This system is not precise if it is applied to a land area of less than 10 m by 10 m. Only three cultivators at *subak* Basang Alas cultivate less than 10 m by 10 m of land. It is impossible to use a pipe which is less than 1 cm in diameter. Four farmers cultivate more than 60 acres but precise water allocation in these cases is not such a problem.

There are other ways to allocate irrigation water amongst *subak* members. For example, *subak* Gunung and *subak* Embukan do not set a measurement to allocate the irrigation water. Each farmer can tap as much water from the tertiary canal (*telabah cacing*) as he needs to irrigate his fields. The flow of water to the *sawahs* (rice fields) is under the supervision of the *pekaseh* and the *kerama subak* (the *subak* members) to prevent excessive usage.

If the available water is not sufficient to irrigate the fields, especially during the dry season, then the *subak* or *subaks* may practise a rotation system. Within the *subak* this is usually under the supervision of the *pekaseh*, and between *subaks* it is under the *sedahan* or *sedahan agung*

For example, *subak* Gunung, Karangasem, comprises fifty members, divided into two groups. Each group consists of twenty five members. The first group, located upstream, gets access to water in the dry season for three days, then the next three days the other group downstream gets the water. The cycle is repeated.

3.12 Subak Temples

Subak temples are dedicated to the agricultural deities, such as Dewi Sri (the rice goddess), Dewi Danu (the goddess of the lake) and Wisnu (the god of the water). For example the Bedugul sanctuary of a *subak* is for worshipping Dewi Sri. The *pura* Ulun Empelan, known also as Kahyangan Ulun Suwi in some *subaks*, is dedicated to Wisnu. This type of temple is situated close to the dam, and can be worshipped in by more than the members of one *subak* if the dam is shared. The *pura* Ulun

Carik is usually found on the top of the complex of rice terraces, and serves also as a sanctuary for the rice goddess Dewi Sri. This type of temple is used by more than one *subak*, and was also founded by more than one *subak*. The *pura* Masceti is associated with defense against pests or other diseases, and, like the *pura* Ulun Carik, the *pura* Masceti is usually worshipped in by the members of more than one *subak*. Not all *subaks* have a Masceti temple, however, and those with them are found mostly in the area of Gianyar, Klungkung and Bangli (Sutjipta 1987:140; Lansing 1987:326-341). Those *subaks* which do not have a Masceti temple observe the ritual of defense against pests and diseases in other temples.

3.13 Traditional Methods of Rice Cultivation and Their Associated Ceremonies

The traditional methods of rice cultivation vary subtly from village to village throughout Bali. Generally the basic cycles of planting, cultivating and harvesting follow a staggered rotation throughout the island, or even within one *subak*. This allows an equal distribution of available water.

Each *subak* decides on a propitious time for planting. This time is called *kerta-masa*, fixed by the *subak* head at a meeting of members. The main factor governing the choice of when to plant are climate and likely water availability.

The *kerta masa* varies from *subak* to *subak*, because water must flow down from upland to lowland *subaks*. Hence a staggered planting timetable evolves, with highest-elevation *subaks* planting first, because they have first use of the water. The same also applies within individual *subaks*. For instance, *Subak* Basang Alas is divided topographically into two groups of fields. The more elevated group consists of three *tempeks* named Sudi, Melanting and Majangan. They are planted out at the end of December and harvested at the end of March. The lower group of fields comprises four *tempeks* named Tegal Linggah, Panti, Buah Linggah and Petung. They are planted at the end of February and harvested at the end of May. Crops such as corn and chili are grown in these lower fields in December and January, until they are flooded in their turn and planted out to rice.

There are two harvests of rice each year. At *subak* Basang Alas, the higher group of *tempeks* is replanted at the beginning of May and harvested in mid-August. The land is rested for about two weeks and then planted with dry crops from September to the end of November.

The same regime is followed for the lower four *tempeks*, with the second rice crop planted at the start of July, and harvested at the beginning of October. Dry crops are grown from mid-October to mid-January.

Most of the work involved in wet-rice cultivation, such as ploughing, seeding, planting, weeding and harvesting, is done by individual farmers on their own holdings, but the timing of planting is organised and decided by the *subak*. If the holding is large, then the farmer usually gets assistance from his household, or through reciprocal labour exchange with other farmers.

The first work done on fields after harvesting is that of cutting the dry stalks. Cleaning and repairing of the water works is done by all the farmers communally, and is organised by the *subak*. This is followed by the *magpag toya* ceremony, during which water is diverted to the rice fields. The fields are flooded for four days to soften the ground in preparation for ploughing. The ploughing itself is preceded by another ceremony known as *ngaturang suninga*, which is conducted in order that the work be done safely. The plough is made of wood with an iron blade and is drawn by cattle. Ploughing, known generally as *matekap* or *nanggala*, is done in 10-16 cm depth of water. The first ploughing is known as *mamungkah* or *mamakal*.

The terraces on the slope are irregular in shape and can be very narrow, conforming to the contours. In areas where it is difficult to operate the plough, especially on narrow terraces and in the corners of fields, cultivation is done by hand using the *tambah*, a broad hoe with a blade of varying weight and shape, set at an acute angle to a wooden handle. This kind of cultivation is known as *numbeg*. The hoe is also used when a farmer has a small holding, without cows, because it is expensive to hire cows to plough. Thus hand cultivation has an economic motivation.

The seed bed (*pamulihan*) is made before or after the first ploughing, according to the type of rice to be planted. For the local type of rice, of which seedlings grow more slowly than those of the new varieties, the seed nursery is made before the

first ploughing, so that when the land preparation is completed the seeds are ready for transplanting. For ten acres of terraces, a seed nursery measuring 5 m by 3 m is adequate. The seed bed is made in the corner of one of the fields. For the local type of rice, entire seed heads complete with panicles are laid side by side on the moist soil. This system is known as *rantaian*. The seed bed is usually surrounded by woven palm leaves as a fence to protect the seeds from ducks or other animals.

The first ploughing (*mamungkah* or *mamakal*) is followed by *ngau*, which is the breaking up of the lumps of the soil using a *gau*, a toothed wooden or metal harrow drawn by two cattle. After this work is completed the soil is fertilized using a green fertilizer of leaves which is dug into the field. After three to five days there follows the repairing of the dikes, which are cleared of grass using a toothed hoe (*tambah magigi*) and sickle (*arit*). Following this the dikes are faced with mud.

After four to five days the fields are ploughed again. Then, a week later, there follows *malasah*, the smoothing and levelling of the mud before the rice is transplanted using a flat board drawn by cattle. Sometimes the excess water is drawn off leaving the mud covered with about three centimeters of water.

When the land is finally prepared, planting is done as soon as possible, usually on the same day as the *malasah* is completed. If the *malasah* is completed in the afternoon, planting will be done the day afterwards generally in the morning. It is important to plant as soon as possible after the land is prepared, so that the rice can grow ahead of the weeds (Grist 1959:125).

The local type of rice is ready to plant after 45 days of growth in the seed nursery, whereas the new varieties take 20 to 26 days. The seedlings are pulled up and bound into small bunches. Then the bunches of seedlings are put on woven bamboo trays and floated in the flooded fields. Planting is mostly done by men, and cannot be done by individual farmers alone. It is usually done together by a *sekaa mamula* (planting group) in the following manner; the bare foot farmers form a row, and step backward into the mud planting the seedlings as they go. The seedlings are spaced at regular intervals, one hand breadth apart, in straight rows.

Planting is preceded by the ceremony called *nuasen* (derived from the word *duase* in the Balinese language) meaning a good day for planting. Prayers and offerings

are made in one corner of the field. This ceremony is observed by individual farmers in their own holdings.

Two to three weeks after transplanting, the first weeding is done. This is usually by hand, as tools can damage the roots of the young rice plants. With the second or third weeding, a tool (*kikis*) is used to cut the weeds. The *kikis* is an iron blade fastened to a wooden or bamboo handle about 2 m long. Three weeks after transplanting the field is fertilized with chemical fertilizer and this is repeated after another seven weeks.

When the rice is 15 to 20 days old, the *neduh* ceremony is observed in a specified temple: the *pura* Dalem Penyawangan at *subak* Basang Alas, and the *pura* Masceti at some *subaks* in Gianyar, Klungkung and Bangli (Lansing 1987:326-341). This ceremony is held on a specific day, usually *Kajeng Kliwon*, in order to make a request to the god to protect the crops from pests or other diseases. The *neduh* ceremony can also be observed any time when it is needed.

At the stage when the heads and the ears swell, the rice is said to be *beling* or pregnant. The new type of rice reaches this stage in 40 to 42 days, but some *subaks* might hold this ceremony when the rice reaches two months of age. The ceremonial requirement during this stage is called *nyambutin padi*. Special offerings are made to ensure the blessing of the deities and to give strength to the crop.

When the rice is flowering the *biukukung* ceremony is observed, to ensure that the rice grows well and flowers safely. *Ngusaba* is another festival held at the *subak* temple; this ceremony is a thanksgiving to the rice goddess Dewi Sri, by virtue of whose blessing the crop grows well. This is the harvest festival, and is celebrated during the last stage of the ripening of the rice. It takes place on certain days, such as a full moon or new moon (Liefcrinck 1969). This rite is also performed by farmers on their individual holdings. Each farmer makes a *nini* (a kind of doll), which is made from a handful of rice panicles with the grains of good rice attached, in order to serve as a temporary seat for Dewi Sri. The *nini* is placed on a *sanggah pengalapan* (bamboo platform) in the middle of the rice field, and presented with certain offerings. Then two days later the harvest begins. When the harvest has been taken home, the *nini* is installed in the granary. The *nini* is not allowed to

be eaten, but must decay by itself. *Ngalapin* and *mantenin* form the thanksgiving ceremonies to the rice goddess for the harvest. Before these ceremonies no rice may be used or sold and they are performed by individual farmers independently in their own households.

Ceremonies related to rice-growing at *Subak* Basang Alas follow the stages of cultivation. Their timing depends on the actual growth of the rice each season. There is no fixed date for a given ceremony, and an auspicious day will be chosen by consensus of *subak* members.

Harvesting is usually done by a group of people called *sekaa manyi* (harvesting group). The local type of rice (*padi del*) is cut stalk by stalk using a tool called an *anggapan* (a finger knife), and the stalks are then tied in bundles. The new high yielding varieties are cut with sickles, and are directly threshed in the field by women, by banging a bundle of rice on a wooden board or a table made from bamboo until the grains fall off onto a spread mat, after which they are collected and put in sacks. Next the grain is sun dried and taken to the rice mill.

Traditionally the local type of rice (*padi del*) with a growing period of 210 days, is threshed on pandanus mats spread on the ground by pounding with rice pestles made from bamboo with a sharp iron circular blade at the bottom. This work is known as *nebuk* and is done by two to four women who encircle the mats, each stepping on a bundle of rice which they pound rhythmically with the pestles. This process is done to separate the individual grains from the rice panicles.

The next stage is dehusking (*nyosoh*), using a *lesung* (a big bowl made of wood or stone) and a *lu* (a rice pounder made from a coconut trunk). Then the rice is winnowed using a flat woven bamboo tray about 1 m in diameter, surrounded with a lip about 3 to 4 cm high. Rice is placed on the tray, which is shaken in a circular way and tossed (this process is known as *napinin*). The result is that the empty husks, light grains and chaff gather around the edge of the tray, and can then be flicked off. The husked rice is then pounded and winnowed a second time. On the second winnowing the tray is held at an angle so that the heavy grains slide downwards, separating them from the lighter chaff.

Intensive wet-rice cultivation using traditional methods is well established in

Abang district, Karangasem. Traditional techniques and organizations, have continued to prevail in spite of the availability of modern technology. Rice growers still operate as members of *subak* irrigation societies, organized according to long-standing traditional rules covering many aspects associated with the growing cycle of rice, including the maintenance of *subak* temples and the observation of ceremonies.

Chapter 4

Wet-Rice Cultivation in the Ancient Balinese Village (9th to 12th Centuries AD)

This chapter mainly focuses on the technology and the social organization of wet-rice cultivation in ancient Bali (9th-12th centuries AD). As background a brief description of the socio-political system of the era is given, to clarify the relationship between villagers / farmers and the state, in particular with reference to taxation, land and water rights.

The most important evidence comes from extant inscriptions on copper plates, which are very important to historians and archeologists for reconstructing the socio-political organization of ancient Bali. Most are not state documents dealing with high level administration, but deal rather with specific local affairs, mostly grants of land from the rulers for the upkeep of temples, rules for the proper maintaining of these grants, and village regulations concerned with marriage, slavery, the inheritance of property of childless people and village security. In the inscriptions there occur many titles of state and village functionaries, but the meanings of most terms remain obscure. There is no descriptive information regarding these functionaries, although they are usually mentioned as witnesses when decrees were issued. Long lists of terms connected with taxation are also mentioned, but again most of them are obscure in meaning. Further research is needed on these matters.

4.1 Rulers and Functionaries in Ancient Bali

Inscriptions from the tenth to the fifteenth centuries and from the European accounts of the sixteenth and early seventeenth centuries suggest that the entire island could have united into a single realm (Swellengrebel 1960:16-24). An Indian model of kingship was adopted at the beginning of the tenth century

in Bali, and the ruler held the highest position in the ancient Balinese socio-political system.

In most Southeast Asian countries the ruler was considered to be a reincarnation of Wisnu or Buddha, as world protector. For instance, in the ancient Balinese period king Anak Wungsu (1049 AD-1077 AD) was considered to be the reincarnation of Wisnu, *saksat wisnu murti*. Most rulers who reigned in ancient Bali were also personifications of Wisnu. The Indian concept of kingship included a mystical charisma which gave a super-human status to the king.

Most Balinese rulers bore the dignified title *sang ratu*, except for Kesari Warmmadewa and Wijaya Mahadewi. The title *adhipati* was attributed to Kesari Warmmadewa in the Blanjong inscription (undated), and he is mentioned without a title in the Malet Gede (913 AD) and the Panempahan inscriptions (undated). The word *adhipati* is derived from Sanskrit, literally meaning "supreme king". Wijaya Mahadewi was the first ruler to bear the title *cri maharaja* (Sanskrit), which means "the great ruler" (Goris 1954a:79; Ardika 1987:60).

There were also *senapatis*, commanders-in-chief, under the ruler. According to Goris (1948:13), this title was analogous to that of *punggawa* in the Gelgel period (1340-1710). The *punggawa* was responsible to the ruler and had jurisdiction over his own territory, and he also acted as a *hulubalang*, or a higher official of the army.

Semadi Astra (1984:46) argues that the territory under a *senapati* was probably the same as the *watek* referred to in ancient Javanese inscriptions. A *rake* or *samgat* in the ancient Javanese period had some sort of jurisdiction over several of the villages within a *watek*, although these villages did not necessarily form a contiguous geographical unit (Christie 1983:17-21; Jones 1984:75-76).

In the inscriptions dated to AD 882-AD 1016, eleven different *senapatis* are mentioned, although it is assumed that more than this number probably existed in

mentioned, although it is assumed that more than this number probably existed in total during this period. The inscription called Manukaya, dated to AD 962/960, mentions several *senapatis*, but because it is in poor condition their names are not readable (Semadi Astra 1984:45). During the 9th-10th centuries the ruler was also assisted by a committee called a *panglapwan*, a word translated as *gerechtshof*, "court of justice", by Goris (1954b:267). This committee comprised *senapatis* and several of the Ciwa and Buddhist priests. After AD 1001, during the reign of Udayana and his wife Gunapriyadharmmapatni, the *panglapwan* became known as the *pakiran-kiran i jro (makabaihan)* (Semadi Astra 1980:40). Besides this committee, several high functionaries are also mentioned in the inscriptions, including *samgat*, *dhikara*, *sarwua*, *nayakan makarun*, *dinganga* and *manuratang ajna* (Ardika 1983:37-43; Semadi Astra 1984:33-41). The duties of these functionaries remain obscure, except the *manuratang ajna*, who is identified as a secretary in charge of records of the king's orders. The *wanwa* or *banwa* was the smallest unit of the socio-political and economic system in ancient Bali. The people who lived within the *banwa* were known as *anak banwa*, "the children of the village". The term *karaman* is also found in the Batuan inscription dated to AD 1022. According to Kartodirjo (1975) citing Soekarto (1970), it may be translated as "village", and a *thani* was a subordinate portion of a *karaman*, perhaps equivalent to the *banjar* (wards) found in present day Bali. A *karaman* thus probably consisted of several *thanis*, had an autonomous status, and was headed by a *rama*.

Semadi Astra (1980:46) has a contrary view to that of Soekarto, arguing that the word *karaman* meant "villagers" referring to the people who lived in the *banwa*. In addition, the titles of several village functionaries are known from inscriptions; these include the *banua tuha*, *manuratang* or *panulisan*, *panundun*, *pratikaya* and the *karaksayan* (Ardika 1983:46-49; Semadi Astra 1984:44-46). The *banwa tuha* might have been a village head and the *tuha* is often mentioned in inscriptions, along with other high functionaries, as a witness when a decree was issued. The *manuratang* or *panulisan*, a secretary, was in charge of records of village administration, and the *karaksayan* was probably in charge of village security (Goris 1954b:295). The business of the other functionaries remains obscure.

desa indicates a mother village which was surrounded by satellite villages. During the Indo-Javanese period in Java, such a grouping of villages was known as a *mancapat* or a *mancalima*. The *mancapat* was a cosmic concept manifested in a grouping of four villages situated according to the cardinal points with a core village in the centre. The *mancalima* layout had eight villages, clustered around a central one in a concentric grouping, and placed at the four cardinal points and the four intermediary points. In old Javanese villages grouped in these patterns, the central units were temple domains instead of simple residential villages (Van Setten van der Meer 1979:58-59). The *pinarimandala cinaturdesa* apparently was the same as the *mancapat* village grouping in the-Indo Javanese period. We do not know whether the *mancalima* village pattern was known during the ancient Balinese periods.

The mother-satellite village pattern also can be seen in the ethnographic records of this period. Covarrubias (1937:58) found that a special relationship often existed amongst a group of villages located in the same area, whereby one temple, in the oldest village, was the original or foundation temple for the whole group. Although basically independent *desas*, the various villages comprising such a related group demonstrate their traditional links through participation in each others' religious ceremonies. Such relationships have been formalized into village federations, with a "mother" or original village as paramount, and its offspring or "daughter" villages as members, it being recognised that the latter all took their origin from the former (Goris 1969:222).

Some details concerned with village administration have been found in some of the inscriptions. The Bwahan A (Kelompok Pertama) inscription dated to AD 944 mentions that the villagers of Bwahan wanted to separate from those of Kedisan. Therefore they requested the king to give them autonomous status (Goris 1954b:83; Budiastira 1978a:31). This evidence shows that Kedisan was probably the mother village for Bwahan, but why the people of the subordinate village wished to separate is not explained.

Evidence for population sizes of villages in ancient Bali can be found in two inscriptions, namely Sembiran A III and Sawan I. Sembiran A III, dated to AD 1016 (Goris 1954a:83), mentions that the village of Sembiran originally consisted of

1016 (Goris 1954a:83), mentions that the village of Sembiran originally consisted of 300 families; it then decreased to 50 because some people were killed or captured by enemies, and some moved away. Other evidence is found in Sawan I (Bila I) dated to AD 1023 (Goris 1954b:101), wherein the villagers requested the king to lighten their taxes because their population decreased from 50 to 10 families. The reason for the population decrease is not stated. From this evidence we have an indication that the population of an average ancient Balinese village probably ranged between 50 families to 300 families. The figure of 300 families may fit best with a mother village, with about 50 families in subordinate villages or wards. This inscription also indicates that there was conflict and war between villages, which had the potential to cause significant decreases in their populations. The Timpag inscription, dated to the 12th century (Budiastra 1977b), is partly concerned with regulations for people who move away from their home village. This inscription mentions that if the villagers of Timpag were to move to another village with permission from the village authority, they would have to pay *tulak sambwang*, *hutang balai perundingan* and a contribution called *bakat-bakat*. The meanings of the terms *tulak sambwang* and the *hutang balai perundingan* are not clear. If they moved out from the village without asking permission they were fined, and their *sawahs* and *ladangs* were taken by the village. In such cases, if they wished to come back to their village, they would have to pay *patahil palupuh* before being allowed to cultivate their *sawahs* again. The meaning of *patahil palupuh* remains obscure.

Although villages were involved in the state political and tax system, in many other ways they seem to have been self-sufficient. They were responsible for the maintenance of peace and order within the village and in their dealings with neighbouring villages; and these matters were fixed by regulations which were usually stated in inscriptions issued by the ruler. Breaking the regulations incurred fines. Responsibilities towards the state consisted of paying taxes and providing labour service or military personnel. The state probably gave protection to villages from invasion, and mediated in legal disputes.

4.2 Taxation, Land and Water Rights

The state required revenues in the form of produce or labour from the people, and the king in ancient Bali had rights to part of the produce of each community.

Most of the Balinese inscriptions deal with taxation, outlining long lists of taxes which had to be paid by villagers and details of tax exemptions. Taxes were levied on rice fields, other cultivated land, water use, artisans, craftsmen, traders, animals, horse breeding and cockfighting. It is difficult to gain a general picture of the taxation obligations on villagers and temples, particularly during the periods not specifically covered by the inscriptions, especially as regards the actual destinations of the taxes. Many of the terms relating to taxation and the officials in charge of tax collection remain obscure, and further research on these is needed.

Van Naerssen (1977:42) points out that the use of the word "tax" is inappropriate when considering the "taxation" system in Hindu Java. The term *drwya haji*, meaning literally "the lord's due", is more instructive. The term *drwya haji* or *dr-bya haji* is also found in Balinese inscriptions (Goris 1954b:239). Inscriptions often record conflict between villages and the officials who collected *drwya haji*; such conflicts often occurred because the tax collectors were corrupt. Probably this was one of the reasons why some villagers requested their ruler to grant their village *jataka* or *sima swatantra* (autonomous land) status for the upkeep of a temple, since the tax collectors were not allowed to enter such estates. The ruler also had rights to statutory labour service, known as *buat haji*, from the villagers. It is often recorded in inscriptions that villagers were obligated or freed from statutory labour service. The nature of the labour is usually not specified, but the inscriptions refer to heavy or light categories of duties.

Taxation and fines related to wet rice-cultivation

The inscription known as Banjar Celepik Tojan Klungkung Kelompok Pertama of 1072 AD was translated by Budiastira (1980a:14-17). It records that the villagers appeared before Anak Wungsu, asking permission to cultivate the rice-field at *kasuwakan* Rawas. It is stated that the villagers had already paid the *laga* to the amount of 5 *ma* to the *kadahulwan* (an official in charge of administering a certain area of rice-fields, to be discussed below). The meaning of the word *laga* is not

known. We can note for comparison, however, that the Timpag inscription (Budiastra 1977b) mentions the words *laga ning banyu*. The word *banyu* literally means "water", hence *laga ning banyu* appears to mean "water contribution". It is likely that *laga* in the present inscription refers to a payment for water.

The villagers referred to in the inscription were exempted from paying numerous specific taxes, of which the meanings remain obscure. They were, however, required to pay *laga* and *barandi* and also to pay *pamli bras*, in the amount of 2 *ku*, to the *sang senapati* Danda. This was due on the ninth day of the lunar month of Magha. On the appointment of a new official known as *admak akmitan* Danda the villagers did not have to pay *barandi*, if it had been already paid to the previous official. They only had to pay when the next payment was due. Villagers were also obligated to provide adequate food (rice) to officials of uncertain function known as *caksu*.

This inscription also mentions that the villagers were given permission by the ruler to clear the forest at Kadandan; after the *watlan* was taken three times, they had to pay *laga* in the usual fashion. This tax was paid to one, or both, of the officials called *sang senapati* Danda and *akmitan* Danda. The term *watlan* is obscure. We can note for comparison, however, that an ancient farmer who initially cleared land was given three years to develop and establish *sawah* fields before becoming liable to pay tax (Van Setten van der Meer 1979:66-67). Hence the term *watlan* probably refers to an exemption from tax, in the same way. In this case, the farmers had to pay the *laga* to *sang senapati* or *akmitan* Danda and it would seem that these two officials were assisted by the *kadahulwan* in the collection of taxes. The villagers did not have to pay the *laga* if their rice-field embankments had collapsed.

Examination of data given in the Banjar Celepik Tojan Kelompok Pertama inscription enable us to gain some understanding of the tax situation. It seems that the *kasuwakan* Rawas was situated at *watek* Danda and was under the *senapati* Danda's jurisdiction. Although the villagers asked permission from the ruler to cultivate the land, it seems that the *senapati* had the right to tax villages under his control, but no rights of ownership. In Batuan inscription of 1022 AD (Goris 1954a:96-101) it was mentioned that the *senapati* owned rice fields, probably granted to him by the ruler as a payment for services rendered.

The Dawan inscription of 1053 AD (Santosa 1965:21) is concerned with the establishment of a *jataka* (freehold estate) for the upkeep of the shrine at Antakun-jarapada. The ruler granted *sawahs* and 30 buffaloes to villagers; in return they were obligated to observe ceremonies at that shrine. The villagers were also obligated to pay the water tax to the official known as *purusakara makapatih*, in the amount of 1 *maca* for each unit of water. We do not know who the *purusakara makapatih* was, nor the quantity of each unit of water. In this inscription the water tax is called *rotting banyu*.

This inscription shows that the tax collector here was called *purusakara makapatih*, was different title from that of *senapati*. We do not know whether the *purusakara makapatih* was the king's tax collector or an official in charge of collecting tax for the benefit of the temple.

The inscription known as Pengotan Bangli Kelompok Kedua, dated to 1069 AD and translated by Budiastara (1978c:34-44), records that the officials in charge of the king's hunting grounds at Silihan and Kundungan appeared before Anak Wungsu to request consolidation of an existing decree from the former king whose memorial *candi* was located at Banu Madatu. This decree was concerned with the *drwya haji* (the king's due) and other duties and obligations of the people who lived on the king's hunting ground. Taxes and tax exemptions were mentioned. Among these was 'water tax', mentioned as not being levied by the official called *nayaka gulma* on the people at the Kundungan hunting ground. No further details are supplied about the *nayaka gulma*.

From this inscription it seems that the *nayaka gulma* was probably a person who was in charge of tax collection in the area of the king's hunting ground, again a different title from those tax collectors mentioned above.

In the Timpag inscription, translated by Budiastara (1977b:5-8), the date and the name of the ruler are not mentioned. Budiastara believes that this inscription was issued by Jayasakti who reigned from 1133 AD-1150 AD. It mainly concerns village regulations, and taxation. In this inscription it is stated that the villagers were exempted from water tax and the *drwya haji* (the king's due).

The inscription Banjar Celepik Tojan Klungkung Kelompok Keempat, translated

by Budiastra (1980a:20-23), is undated but was issued by Jayapangus who reigned from 1177 AD-1181 AD. It records that the king's rice-fields had been neglected and he duly granted these lands for the upkeep of the Er Rara temple; two-thirds of the harvest was for that purpose, and one-third for himself. It is stated that the villagers mentioned in the inscription were exempted from taxes. However, they were obligated to pay *bungan bwah* in the amount of 1 *ku* for each *tambuku* (unit area of land irrigated by one water divider, see chapter III and below).

The inscription also mentions penalties related to wet-rice cultivation. It records that if rice be eaten by buffaloes or cattle, or stolen, the matter had to be reported to the *caksu*. If this happened because of negligence, the guilty party had to pay *sipat* (fines) of 1 *ku* to the *caksu*.

Thus we can see that although the king granted lands for the upkeep of a temple, not all the produce of the lands went to that temple. The sharecroppers who worked these lands were not freed from water tax, either.

In the Bwahan Kelompok Keempat inscription translated by Budiastra (1978a:44-51) dated to 1181 AD, and issued by Jayapangus, the king ordered that the villagers of Jhuharan be given autonomous status. This status was granted because there was a conflict between tax collectors and the villagers. The *drwya haji* (the king's due) was collected from Jhuharan, but was then directed by the ruler towards village maintenance and the well-being of the villagers. The *drwya haji* related to wet rice-fields and gardens was not returned in this way, but was paid to the head of the *kasuwakan* (irrigation association) in the amount of 10 *ma*. The taxes had to be paid at a meeting (it is not stated where) on the third day of Cetra month and were collected by the tax collector. Probably the meeting was held in the village, and the head of the *kasuwakan* was responsible for assisting the tax collector in collecting taxes at the *kasuwakan* level.

From the inscriptions mentioned above, it appears that taxation was neither centralized nor particularly systematized. Officials who were in charge of collecting taxes in different jurisdictions, such as the *senapati* territory, the king's hunting ground, villages and temple, bore different titles. Although some villages were given freehold land (*sima*) for the upkeep of the temple, some taxation obligations re-

maintained. Besides the water tax, farmers had to make other contributions, observe ceremonies and maintain the village temple and the public buildings.

The head of *subak* Basang Alas, I Made Anom, advises that present-day farmers who cultivate communally-owned village land (*tanah ayahan desa*) still have to pay water tax to the *subak*. In the past, this land was granted by the ruler of Karangasem to the villagers. In return for these cultivation rights, the beneficiaries were and still are obligated to maintain their village, repairing the village temples and public buildings and observing ceremonies.

The right to cultivate the *tanah ayahan desa* is hereditary in nature, passed down the patrilineal line. When a farmer dies without male heir, the disposal of rights becomes a decision for the village council. The council will usually try to identify the relatives of the deceased, or in default, other villagers, who do not yet cultivate any *tanah ayahan desa*. The rights are also confined to those who are married, known as *tuwun ngayah*.

Land beneficiaries, both past and present, are subject to a system of taxes. Farmers at *subak* Basang Alas at present pay land tax to the Indonesian Government and water tax to the *subak*. In addition, villages place restrictions on farmers selling their rights to cultivate communal land. Generally a farmer is expected to sell his rights to another farmer within the village. The selling of such rights also entails the passing of associated communal duties to the buyer as holder of the *tanah ayahan desa*.

Land Rights

Ownership of land in ancient Bali appears to have been very complex, as it still is now. The situation in ancient times continues to be a subject for debate.

Evidence from inscriptions, deciphered by van Stein Callenfels, indicates that ownership of land was not a royal prerogative. Villages, irrigation societies (*subak*, temples, and villagers all owned land (Callenfels 1947:203-205). The ruler appears to have generally controlled the agriculturally unusable areas such as mountain forests, gullies and the like, but only a fraction of the cultivated lands. Van der Kraan (1983:318) remarks on the absence of any evidence in the inscriptions for land tax collected by Balinese rulers, an absence which suggest that they exercised no overall

control of land. On the other hand, landowners did have to pay a tax on irrigation water used, the quantity of which would of course depend on the extent of the lands they had under irrigation. Van der Kraan attributes the basis for such a tax to the ruler's control over the source of all irrigation water, that is, the uncultivated upland headwaters of all the streams.

The following evidence from inscriptions shows that the ruler of the day was engaged in buying and selling land, and granting land to villages, temples and individuals.

In the Sukawana AI inscription, dated to AD 882, the king orders a monastery and an official rest-house to be built at his hunting ground at Cintamanimmal. The married priests living there were freed from some taxes and corvée labour. The area thus became a *sima* (freehold estate), which meant a change in its taxation status. The inscription is therefore a legal document recording the fact that the revenues of the area were henceforth to be devoted to the upkeep of a temple. The boundaries of the *sima* were fixed and the priests were exempted from paying further taxes (Goris 1954a:56).

There are other inscriptions concerned with the establishment of freehold estates for the upkeep of temples or monasteries, such as Trunyan A II dated to AD 911 (Goris 1954a:58). It records the king's orders to the village council of Turunan to build a temple for Bhatara Da Tonta. It also stated that the villagers were freed from certain taxes and corvée, in return for which they were obligated to perform ceremonies and maintain the temple.

The Gobleg Pura Desa A inscription (undated) (Goris 1954a:7) is concerned with the establishment of a *sima* estate for the upkeep of the Indrapura temple at the village of Air Tabar.

The Bedulu inscription, dated to AD 968 (Tara Wiguna 1981:91-102 ; Ardika 1984:21), records the establishment of a *sima* estate for the upkeep of the temple of Hyang Api.

The Babahan inscription of AD 917, issued by Ugrasena (Goris 1954a:64), mentions that the king granted lands to a *pitamaha* (priest) at Buwunan called Ida Bhiksu Dharmmecwara; also to a *pitamaha* at Songan, called Bhiksu Dharmmac-

chaya, and to the hermitage at Ptung. The borders of these *simas* were fixed.

The Sembiran A II inscription of AD 975, issued by Janasadhu Warmmadewa, mentions that the villagers of Julah were exempted from taxes and were obligated to maintain the temples, plantations, water-works, and *prasada* temple(s) at the village of Julah, Indrapura, Buwun Dalem, and Hiliran. We do not know if the last three names mentioned refer to separate villages, or just to separate locations within Julah village itself. If the last three names do refer to separate villages, then the villagers of Julah had to perform maintenance work for them.

The Sangsit A (Blantih A) inscription of 1058 AD mentions that the villagers appeared before the ruler to seek the granting of freehold (*sima*) land status for their village, for the upkeep of a temple.

The Srokadan B (Sukawati C) inscription of 1077 AD, issued by Anak Wungsu, mentions that the villagers appeared before the king for the same reason, in respect of the temple at Air Karakantaralaya .

In the inscription of Manik Liu AI, dated to AD 958, it is stated that the ruler granted a piece of land to a *samgat juru manjjahit kajang* (a tailor), and his son, who was called Bandat. Both were exempted from taxes, and from both heavy or light labours.

The Dawan inscription, dated to AD 1053, mentions that the ruler established a *sima* at Lutungan village for the upkeep of the Antakunjarapada temple, and 30 buffaloes were also granted to the villagers. The villagers who tilled the lands were obligated to pay water tax.

The Pandak Bandung inscription is dated 1071 AD and was issued by Anak Wungsu. It has been translated by Budiastira (1979), and records that the king purchased lands including forest, *sawah* and *ladang* for the upkeep of the Antakunjarapada temple. The king purchased the land from the "son of the king who died at Senamukha". We do not have enough information about this person, or his relationship to Anak Wungsu.

The Bwahan Kelompok Kedua inscription of 1025 AD, issued by Jayapangus, records that villagers appeared before the king and requested to buy the king's hunting ground, which was close to their village. The *senapati* Dinganga and *mpungkwing*

Dewasamoha Pu Santusti acted as mediators. This request was placed before the ruler because the villagers needed more land for grazing their cattle and for collecting firewood. The area of the land measured 900 *depas* by 1100 *depas* (a *depa* is the span of a man's outstretched arms, approximately 2 metres). The borders of the land were fixed.

The tax imposed on wet-rice fields seems to have been a water tax, not a land tax. This situation can also be seen in the later period of the Balinese principalities, as described by Geertz (1980:68), wherein the tax on wet-rice cultivation was considered to be not a land but a water levy. It was therefore assessed in terms not of field size but of the quantity of water used by the farmer for irrigation .

Water Rights

Balinese inscriptions from the period of AD 994-AD 1048 show that the ruler sometimes controlled the use of water (e.g. the Klungkung inscription of 1072 AD), but references to the possession of water rights do not indicate ownership by rulers. Hence the situation noted by Liefrinck (1890), that the ruler had sole authority over the use of water, most probably developed subsequent to the period covered by the inscriptions, as was concluded by van Stein Callenfels (1947).

Stein Callenfels' argument that water rights were not solely in the hands of rulers is in accordance with information obtained by me from *subak* Abang, Karangasem. In my field work there it was established that water control in the 19th century was in the hands of I Gusti Ring Jero Abang, the head of a noble family in *kecamatan* Abang, which was under the Karangasem ruler in the 19th century. I Gusti Ring Jero Abang constructed the irrigation works, including a dam, conduits and the canals running to the individual holdings. He also performed the *subak* ceremonies at the Bedugul and Ulunsuwi temples. The farmers contributed one quarter of their yields to their lords to pay for water, and if they acted as sharecroppers they paid one quarter of their yields for water, one half to the owner for the use of lands, and kept one quarter for themselves.

In 1884 the water system was totally destroyed by flood, and all the irrigation structures were washed away. The lands were then neglected for 25 years until, in 1909, under Dutch colonial authority, the cultivators together with the owners of

the land and the village council, proposed to rebuild the water works. This was approved by the Dutch, who also decided that I Gusti Ring Jero Abang would not be permitted to control the water, but had to sell the rights to the owners of the lands. The water rights were then purchased by the owners of the land for 15,000 *kepengs* per 10 hectares. The payment was made within 2 months, after which a meeting was held, attended by the sharecroppers, the owners and the village council, under the auspices of the colonial authority. The meeting discussed the reconstruction and maintenance of the water works, and it was resolved that the work and the performance of the necessary ceremonies should be managed by Abang village. The Abang villagers were therefore freed from statutory labour service for the Dutch authority for one year. Further, the meeting also decided that the village community should be rewarded with 28 kilograms of rice per hectare per year by the land owners.

By 1930 the river water was becoming lower, and the village community was not capable of maintaining the water works. This problem was put to the colonial authority, and it was decided that the cultivators (both sharecroppers and active owners) had to form a *subak*. Thus *subak* Abang was founded in 1930, consisting of 107 members and divided into two *tempeks*. *Tempek* Andong comprised 14.750 ha. of *sawah* and *tempek* Butuk comprised 20.705 ha.

Ever since the foundation of this *subak* all the members of the village have been obligated to perform work for it, on tasks such as repairing the water works once a year for a period of about two to three hours per person. Besides that, they are also obliged to perform the *magpag toya* ceremony. The rest of the rituals (see chapter III) and collective work such as cleaning and repairing the water works are performed only by *subak* members.

Generally speaking, *subaks* have mostly been founded by villagers after clearing and dividing new land for *sawah*, and then going on to form a *subak* association. However, in this case, at *subak* Abang, the formation of the *subak* occurred in respect of *sawah* land which was already extant, when its irrigation water passed to the village council from the control of a noble family. Previously, all aspects of irrigation infrastructure maintenance and the performance of ceremonies were taken care of

by this noble, to whom water tax was paid by the farmers. The formation of a *subak* under such circumstances appears to be unique in Bali.

Stein Callenfels' position on the control of water rights was contrary to that of Lieftrinck. Based on field work in Buleleng, Lieftrinck (1886 (1969)) postulated that water rights were solely under the ruler's control. This study was done during the colonial period, and the above mentioned situation at Abang occurred at the same time. The facts of this latter case indicate that water control was not solely in the hands of the ruler, but it was in the hands of the head of a noble family unlike the situation Lieftrinck described. The *subak* Abang case therefore supports Stein Callenfels' argument. Perhaps there was variation from place to place concerning water rights.

4.3 Kasuwakan (The Forerunner of the Subak)

The term *kasuwakan* is found in some Balinese inscriptions, such as the Pandak Bandung inscription dated to AD 1071 (Budiastira 1979) and the Banjar Celepik Tojan Klungkung Kelompok Pertama (Klungkung A) inscription dated to AD 1072 (Goris 1954a; Budiastira 1980a). Both were issued during the reign of king Anak Wungsu. The Pandak Bandung inscription states, "... *mwang yatna ta ya irika haywakna nikang sawah knepanya, ri kasuwakan telaga...*" (IIa.5). - "...they have to repair the *sawah* at *kasuwakan* Talaga, ..". The Banjar Celepik Tojan Klungkung Kelompok Pertama inscription states, "...*sambhandhahyun gumawaya ikanang sawah kadan-dan i kasuwakan rawas kramanya pinalaku nya...*" (1b.2).- "...the purpose of the villagers appearing before the ruler is to request to be allowed to cultivate the *sawah* Kadandan at *kasuwakan* Rawas...".

The term *kasuwakan* is also found in the Pengotan Bangli Kelompok Keempat inscription, which Budiastira (1978c) believes should be dated to the 12th century. This mentions that the extent of *sawah* at a village called Udanapatya was 19 *kasuwakans*. Each *kasuwakan* was given a name "...*kasuwakan padang aruna, kasuwakan dapdap, kasuwakan den rumah...*" (IIIb.2-6).

The term for "irrigation association" in modern Balinese is *subak*. The evidence from the inscriptions is that water control and distribution were probably handled

by the organization known as the *kasuwakan* in the Old Blinese period. This is supported by the Batuan inscription issued by Marakata and dated to AD 1022 (Goris 1954b:100), in which the word *makaser* is mentioned: “...*aduman ta ya kilan 2, kilan 10, maring air gajah kilan 8 maring makaser...*”(Vb.5) - “... (each of them) get 2 *kilans*, 10 *kilans* from Gajah River and 8 *kilans* from *makaser...*”. The term *pakaseh*, which seems to be derived from *makaser*, is found in modern Balinese and refers to the head of a *subak*. The phrase thus indicates that the division of water was under the supervision of a *makaser*, who seems also to have been the head of the *kasuwakan*.

The wet-rice fields (*sawah*) in a village were managed by several *kasuwakans*, as noted above the Pengotan Bangli Kelompok Keempat inscription. Each *kasuwakan* at Udanapatya was given a name, although it is not known what the names were related to or associated with. Nowadays each *subak* also has a name, which is usually the same as that of the village or wards, or the name of some geographical feature. The borders of the *sawah* are also often mentioned in the inscriptions. These were usually marked by geographical features or the boundaries with adjacent villages. In present-day *subaks*, the location of borders is always mentioned in the *awig-awig subak* (*subak* regulations). The inscription Banjar Celepik Tojan Klungkung Kelompok Ketiga, dated to 1072 AD, indicates that the extent of the wet-rice fields controlled by *kasuwakan* Rawas at Er Rara was more than 19 *kadahulwans*. From this phrase we assume that a *kadahulwan* was an organisational subdivision of a *kasuwakan*. Nowadays, subdivisions of *subaks* are known variously as *tempeks*, *munduks*, *banjarans* and *arahans*. According to the above inscription, between one and five *sawahs* were grouped under one *kadahulwan*. The reason for the grouping of *sawah* into *kadahulwan* was not clarified, but was probably for administrative efficiency of irrigation control, as in the present-day situation. Often the word *kadahulwan* was also used to refer to the area of *sawah* managed by a *kadahulwan* organisation. This was headed by an official whose title was the same word, *kadahulwan*. The inscription Banjar Celepik Tojan Klungkung Kelompok Pertama, dated to AD 1072, and issued by Anak Wungsu (Budiastra 1980a), states, “...*sambhandhahyun gumawaya ikanang sawah kadandan i kasuwakan rawas karamanya*

pinalakunya laga pariduh maca 1, kadahulwan, manahura sapurwusantatinya mula ma 5 saputhayu, tan panusuna, ri sakadahulwan... (1b. 2-3). - "... the purpose of the villagers appearing before the ruler was to ask permission to be allowed to cultivate the lands in *kasuwakan* Rawas, because the *laga* had already been paid in amount of 5 *ma* to the *kadahulwan*..."

Probably the *kadahulwan* (here referring to the head of the *kasuwakan* sub-division) assisted the *makaser* (the head of the *kasuwakan*) in collecting taxes at the *kadahulwan* level. The analogous situation can be seen in the present-day *subak*, where the head of the *subak* is assisted by the *klian tempek* (the head of a *subak* sub-division) in collecting taxes at the *tempek* level.

4.4 Irrigation Methods in Ancient Bali

The ancient Balinese irrigation system was generally on a small scale, fundamentally reliant on gravity. Dams, canals and terraces were of simple construction, made from coconut trunks, palm trunks, logs, bamboos, stones. The evidence from inscriptions, as outlined below, also confirms the existence of such a system of irrigation in ancient Bali.

Bali is mountainous, so a system of terrace irrigation suits the environment. The fields were irrigated by damming continuously-flowing rivers, sometimes tunnelling to divert part of the stream. Water was then directed to the fields through canals. The dams also retained flood waters during the rainy season. Often heavy rain damaged the water reticulation system because of its relatively fragile construction.

The term *dawuhan*, found in the Timpag inscription, refers to a dam of earth, logs or stones built to hold back the water. The term *kali*, found in the Timpag inscription (12th century), also the Pandak Bandung inscription (AD 1071) and the Bwahan inscription (AD 1181) refers to a river or canal (Budiastra 1977b; 1978a; 1979). The term *undagi pengarung* is found in Bebetin A (AD 896) and the Batuan inscription (AD 1022) (Goris 1954a:55-97); *pengarung* derives from an old Balinese root *arung*, which in modern Balinese has become *aung*, from which is derived *aungan*, meaning a tunnel for irrigation water. *Undagi* means skilled worker, so *undagi pengarung* meant "tunnel builder" (Swellengrebel 1960:10-11).

The term *tambuku* is found in some inscriptions, such as Batuan (AD 1022) (Goris 1954a:100); Pandak Bandung (AD 1071) and Banjar Celepik Tojan Klungkung Kelompok Keempat, undated but issued by Jayapangus, who reigned from AD 1177 to AD 1181 (Budiastra 1980a:25). The term *tamuku* or *tambuku*, as used in modern Balinese, refers to a water divider. A *tambuku* is made from logs or coconut trunks set across a canal to divert water to the fields. (See chapter III). In the Banjar Celepik Tojan Klungkung Kelompok Keempat inscription we read, "... *tuhun kweh nikang sawah sinamah linawakaken ikang dharmma i errara, mangaran i jalingjing wetan satambuku pangdingdingnya luwang 6 i piling...*" (b.2-3) "... the extent of the rice fields for the upkeep of the Er Rara temple is one *tambuku pangdingdingnya luwang 6* in eastern Jalingjing ...". In this inscription the term *satambuku pangdingdingnya luwang 6* means "a water divider with an aperture of 6 *luwangs*". There is no detailed explanation of this expression in the inscription, but it is used as an indicator of field size (one which was irrigated by a water divider 6 *luwangs* wide). A *luwang* is literally a hole, but apparently the term refers here to a standard measurement of width of the gap in the *tambuku*, through which water flowed to the fields. Thus, a field may be described as 1 *tambuku* or 2 *tambukus* etc in extent. The Srokadan inscription of AD 1324 also mentions that the *sawah* possessed by Bhatara Candri-manik (this reference is unclear) had an extent of 2 *tambuku* (Budiastra 1977c:7). However, we do not know the basic unit size of such fields.

The term *kilan* was used for the measurement of the aperture in the *tambuku* during the reign of Marakata in the 11th century AD, and it seems to be equivalent to the term *luwang*. *Kilan* was derived from old Javanese and meant a span from the thumb to the little finger. It was used for the proportional allocation of water, as can be seen from the Batuan inscription dated to AD 1022 (Goris 1954a:100), "her *karamaning baturan tumut makaser ring air gajah mangalapan ring pujung ngaji aduman ta ya kilan 2, kilan 10 maring air gajah kilan 8 maring makaser...*" (Vb.5); which means that "the water was divided in to 2 *kilans* for each of them (the cultivator). Ten *kilans* of water were obtained from Gajah River and 8 *kilans* were given by the head of *subak*".

In other words, using this example, the quantity of water referred to as being

obtained from the Gajah River, was that amount which flowed through a *tambuku* whose aperture was 10 *kilans* in width. The depth of the *tambuku* aperture is not referred to, and indeed is variable in present-day Bali. On average it is about eight centimeters (Budiastra 1977b:14). No physical remains of ancient Balinese water systems have been found. This is because the systems have been continuously modified and reconstructed, eventually removing all traces of earlier configurations. Evidently the villagers did not need to ask permission from the ruler to repair damage to their *sawahs*, so construction and repairs to the water system were mainly done by the villagers themselves, and there is no evidence of any active involvement at the state level of organization.

The Banjar Celepik Tojan Klungkung Kelompok Pertama inscription, dated to AD 1072 (Budiastra 1980a), is mainly concerned with taxes and agriculture issues. It mentions that the villagers did not need to ask special permission to repair dams, and were allowed to cut down trees including coconuts, betel nut palms, bamboos and others. This inscription does not mention explicitly the purpose for cutting down the trees. However, the context suggests that they were needed for the construction of the water system. Nowadays a simple dam construction uses coconut trunks or logs tied together with bamboo rope and set across the river to raise the water to a certain level. Another method is to put stones in woven bamboo baskets to barricade the river. A log or a coconut trunk can also be used as a water divider, set across a canal, and bamboo is used for inlet and outlet water pipes. A betel nut trunk is used for aqueducts, made by splitting the tree trunk into two lengthwise, and hollowing it out. If the trunk is not long enough then two or three are joined together end to end by bamboo rope, and are then placed so as to permit water to flow from field to field across intervening low-lying ground.

Evidence that rulers sometimes ordered villagers to repair and construct water works is found in the Pandak Bandung inscription (AD 1071) (Budiastra 1979), the Bwahan Kelompok Keempat inscription dated to AD 1181 (Budiastra 1978a), and the Timpag inscription dated (based on palaeography) to 12th century AD (Budiastra 1977b). The Pandak Bandung inscription states, "... *mwang yatna ta ya irika haywakna nikang sawah knepanya, ri kasuwakan talaga, 3 tambuku galeng 300 kaho*

pangdingdingnya luwang 26 kihanya 50 wijil kulang kaling (IIa.5-6). This means that the villagers had to repair the *sawah* at *kasuwakan* Talaga whose area was 3 *tambuku galeng.kahopangdingdingnya luwang 26 kihanya 50 kulang kaling*. We can not clarify the extent of *sawah* referred to since a very complex terminology is used here. Evidence for the construction of water works is also found in the same inscription. The villagers were given permission to construct a series of canals and ditches, and they were allowed to divert water from other *panggunturan* (the meaning of this word remains obscure). They were also given permission to cut down and burn protected trees, without penalty, if these obstructed canals or interfered with the coconut trees, *sawahs*, or houses. The Bwahan Kelompok Keempat inscription is partly concerned with agricultural issues, and contains very similar information to the Pandak Bandung inscription. It mentions that the villagers were given permission to construct canals, to cultivate land, and to cut down protected trees which were shading or damaging the *sawahs*, garden, houses, meeting houses, and house fences.

The Timpag inscription states that the villagers were allowed to repair their *sawah* without asking permission from authorities (names and titles not mentioned), or from other officials called *sang admakmitan apigajih* and *aninggi*. They were excused from paying water tax, and given permission to cut down protected trees which were shading *sawahs* or interfering with canals.

The evidence from inscriptions thus shows that Balinese water works in ancient times were on a small scale, and made with simple technology. They were built and maintained by the villagers themselves through cooperative effort. The ruler did not take an active role in the construction and maintenance of water works, but only issued regulations concerned with exemptions from paying water tax, the cutting down of preserved trees, and the building and extension of water works.

The foregoing data concerning land and water rights and small-scale co-operative agricultural system managed by the *subak* irrigation association in Bali, accord with the findings of van der Kraan (1983:313-322) that the Marxian concept of an Asiatic mode of production is not tenable in the case of Bali. This concept basically states that the large scale labour requirements necessary for constructing irrigation systems

required supervision and control by the state. Furthermore, the state owned most of the land in societies thus conceptualized, and so could reap the profits of surplus agriculture production. Wittfogel (1959) developed this concept to the point of proposing the concept of the "hydraulic society" with a despotic ruler overseeing massive-scale irrigation works, using corvee labour, in a climate of coercion, even terror.

Although the concept of the Asiatic mode of production may have some historical validity in other parts of South East Asia, van der Kraan asserts that the Balinese irrigation and agricultural system was fundamentally different. The Balinese *subak* has since ancient times been essentially a small-scale local irrigation organization independent of the state. The economic role of the state was restricted largely to the collection of taxes. It did not own the majority of arable lands and was in no position to exert a despotic domination of the commoners. Moreover, the case of *subak* Abang mentioned above under the heading "Water Rights" confirms the inapplicability of Wittfogel's thesis to Bali. In this case, the water rights for the village were originally in the hands of noble family. Although this noble family was ordered by the Dutch authorities to sell its water rights to the villagers who cultivated the lands, the major point is that the ruler himself did not exercise control over water rights in this instance. A despotic ruler in the Wittfogel mode, rather than a noble family, would controlled these water right if the Wittfogel hypothesis were applicable to Bali

4.5 Cultivation Practices in Ancient Bali

The opening up of new land for cultivation by clearing forest was done by villagers together as a co-operative effort. The land would be cleared after receiving permission from the ruler, after which it would be divided amongst them. The words *amabaki* and *mangharapuh* refer to clearing the land for cultivation. The word *babad* is also found in the inscription Pura Abang A dated to AD 1021, issued by Udayana Warmmadewa (Goris 1954a:93; Tarawiguna 1987:6). This word is derived from old Balinese, meaning to cut down trees (Granoka 1985:11), and it is still used in modern Balinese. The Banjar Celepik Tojan Klungkung Kelompok Per-

tama inscription dated to AD 1072 and issued by Anak Wungsu (Budiastra 1980a) mentions, " ..., *mangkana yan hana alas thani ning kadandan wnanganya mabakana ya,...*" (1 b. 6-2a. 1-2).- " The villagers were given permission by the ruler to clear the forest at Kadandan."

Both dry and wet-rice cultivation methods were practised in ancient Bali. For example, the Sukawana AI inscription, dated to AD 882, and written in the old Balinese script and language, contains the word *huma* for a wet-rice field. It is not clear in the inscription, however, whether the fields were fed by rain water or by irrigation canals. The terms used for a wet-rice field in modern Bali are *huma* or *uma*, *carik*, *sawah* and *bangket*. In later periods, when inscriptions were no longer written in the Balinese language and Old Javanese was used, the Javanese term *sawah* appears. For instance, it occurs in the Batuan inscription dated to AD 1022 (Goris 1954a:100), the Pandak Bandung inscription dated to AD 1071 (Budiastra 1979), the Banjar Celepik Tojan Klungkung inscription dated to AD 1072 (Budiastra 1980a), and the Bwahan Kelompok Keempat and the Bwahan Kelompok Kelima inscriptions both dated to AD 1181 (Budiastra 1978a).

The words *parlak*, *kebwan* and *mmal* referred to dry cultivation. We do not have clear evidence to describe the differences in meaning between these terms. In the Tulukbyu A inscription dated to AD 1011 it is stated that the villagers asked to clear a ruler's hunting ground to convert it to *kebwan* (cf. Bahasa Indonesia *kebun* meaning a garden). The ruler agreed to the villagers' request, and they were told to cultivate the land diligently. They planted it with *gaga* (dry rice), taro, onion, ginger, and safflower. The term *pagagan* is found in the Bwahan Kelompok Keempat and Sukawana A inscriptions, both dated to AD 1181, where it referred to a dry-rice field. *Padi gaga* is also the term used in modern Balinese for rice cultivated in permanent untterraced dry fields on slopes.

The word *parlak* also referred to a dry field planted with *gaga*, using slash and burn (swidden) techniques. *Parlak* has the same meaning as *ladang* in Bahasa Indonesia (Granoka 1985:70). This kind of shifting cultivation is still practised in other parts of Indonesia, especially Sumatra and Kalimantan, but is no longer practised in Bali due to the shortage of land.

The word *mmal*, also found in Balinese inscriptions, is translated as Dutch *tuin* by Goris (1954b:277), meaning a garden (Woyowasito 1980:130). A *mmal* was planted with trees such as coconut, bamboo, mango, candle nut and also ginger (Budiastra 1977a:40). The term *padang* is often mentioned together with *mmal*, *kebwan* and *huma*. It is translated as Dutch *grasveld* or *weide* by Goris, meaning a grassland (1954a: 28). It was probably grazing land for cattle or water buffaloes since *padang* in modern Balinese means grass, and *padang rumput* in modern Bahasa Indonesia means grazing land. The Bwahan Kelompok Kedua inscription dated to AD 1025 (Budiastra 1978a) mentions that the villagers bought the king's hunting ground in order to have a more extensive area for collecting fire wood and for grazing.

Balinese inscriptions show that wet-rice cultivation was already intensified at the beginning of the eleventh century. The Songan Tambahan inscription, issued by Marakata (11th century AD), mentions various stages of *sawah* cultivation, listed as *amabaki*, *amaluku*, *atanem*, *amantun* and *ahani*. These words have been translated by Soekarto (1985:33): *amabaki* is to clear the land; *amaluku* is to plough; *atanem* is to plant; *amantun* is to weed and *ahani* is to harvest.

The Bedulu inscription, dated to AD 1067, also mentions the stages of cultivation, (Tara Wiguna, 1981:141). This gives the terms *mangharapuh*, *mamula*, *majukut*, *mangharanyi* and *manutu* (ibid.p.64). *Mangharapuh* is to clear the land; *mamula* is to plant; *majukut* is to weed; *mangharanyi* is to harvest, and *manutu* is to pound. A word for plough is not given in this inscription. The existence of these terms points to an already-elaborated system of wet-rice cultivation at that time.

The names for the stages of cultivation mentioned above are generally the same as those found in present-day traditional wet-rice cultivation in Bali. The word *amaluku* (plough) has become *maluku* in modern Balinese in some areas. The other word for *maluku* is *matekap* or *nanggala*. The words *mamula* and *atanem* mean to plant, and in modern Balinese they are *mamula* and *nanem*. The term *majukut* means to weed, and this remains *majukut* in modern Balinese. The words *mangharanyi* or *ahani* mean to harvest, as does *manyi* in modern Balinese. This correspondence between ancient and modern cultivation terms support the

hypothesis that the methods practised in ancient Bali were not much different from current traditional methods of wet-rice cultivation.

To date no archaeological evidence for the implements used for wet-rice cultivation in ancient Bali has been found. Some inscriptions mention certain implements, although it is not explicitly stated whether they were used in wet-rice cultivation. For instance the Pura Tulukbyu Kelompok Kedua inscription, dated to AD 1181 and issued by Jayapangus (Budiastra 1980b:34), states that villagers were not allowed to steal sickles, krises, chopping knives, axes, crowbars and other things. Furthermore, blacksmiths (*pande bsi*) are mentioned in the Pengotan A I inscription of 924 AD (Goris 1954a:67). Certainly, buffalo were in domestic use at that time, and are commonly mentioned in inscriptions. Given the degree of sophistication of metallurgy evident from the various implements mentioned in the Tulukbyu inscription, and having regard to the relatively simple iron plough blades, sickles, hoes and other tools in use today, it can be reasonably hypothesized that the implements used in ancient Bali were not much different from those used today in the traditional practise of wet-rice cultivation.

Chapter 5

Conclusion

Comparison of data from the ancient inscriptions with more recent ethnographic evidence, together with information provided by informants personally involved in wet-rice production in Bali today, indicates a high degree of similarity between present-day and ancient (9th to 12th centuries AD) practices, especially in the areas of social organisation and technology.

In recent and colonial times, rice growers have organized themselves into co-operative irrigation societies known as *subak*. Evidence from inscriptions shows that similar associations existed in ancient times. These were called *kasuwakan*, and details of their structure and function are analogous to those of the modern *subak*. Both were and are concerned with the orderly irrigation of areas of rice – fields whose borders are fixed by reference to geographical features, adjacent villages and hamlets. Both always bear names. Both are divided into constituent “sub-committees” which each manage a portion of the whole area under cultivation by the *kasuwakan* / *subak*. The head of both the modern and ancient institutions assist in tax collection on behalf of the relevant higher authorities. The etymological relationships between the terms *subak* (modern) and *kasuwakan* (ancient) and between officials *pekaseh* (modern) and *makaser* (ancient), cannot be coincidental.

With regard to the technology of water reticulation for the irrigation of rice fields, the evidence again points to very minimal changes in technique over the last eleven centuries. Ancient techniques, such as damming creeks with palm logs or stones in cane baskets, digging canals to the fields by hand with hoes, using hollow betel nut

betel nut trunks as open conduits and bamboos as water pipes are all practised still today. The proportional allocation of water to the various rice fields irrigated from one source is still effected by the system of a water divider provided with apertures of standard widths, as in the ancient system. The old term for these dividers (*tambuku*) is still current.

Evidence for the continuity of wet-rice cultivation practices over time is found in the survival to the present-day of several terms relating to the stages of rice growing. Current practices of ploughing, planting, weeding and harvesting all have Balinese words which are obviously derived from their ancient equivalents as found in the inscriptions. These is less-concrete evidence for the continuing use of similar agricultural implements, as these are not specifically referred to in the inscriptions. However, it can be inferred, from those tool types which are mentioned, that implements of a similar level of technology were in use for rice cultivation then as now.

It is thus apparent that the traditional techniques of wet-rice cultivation, as practised in Bali today, have been employed in their major particulars since at least the times of the available inscriptions of the 9th to 12th centuries AD. These is also strong evidence that the present-day irrigation societies, the *subaks*, also had very similar counterparts during this period.

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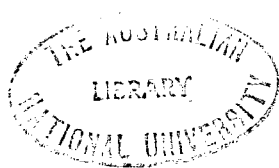
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Appendix added in accordance with examiners' request :

The following information on *subaks* was obtained through informant interviews in Bali.

The research was conducted in the three villages of Abang, Ababi and Tista, in *kecamatan* Abang, *kabupaten* Karangasem. The five *subaks* examined were *subak* Abang of Abang, *subak* Basang Alas of Tista, and *subaks* Bekukih, Embukan and Gunung of Ababi. The research focused on the functions of the *subak* offices and on the technology of wet rice cultivation.

In order to collect data on present-day *subak* organization and wet-rice cultivation in Bali, a two month period of field work was conducted. Data were gained by observing the farmers in their fields and by interviewing *subak* heads about organizational structures and the traditional methods of wet-rice cultivation.

Considerable variation is found in the linguistic terminologies and organizational structures associated with *subaks* throughout Bali. These variations reflect factors such as diversity of water sources, sizes of *subak* land holdings, numbers of *subak* members, and local socio-economic contexts and traditions.

I. Subak organizational structures.

Subak Basang Alas is headed by a *keliang* (*kliang*). There is also a *pekaseh* who is responsible for maintenance of the water works. This differs somewhat from the more usual *subak* organizational structure where the head, called either *kliang* or *pekaseh*, combines responsibility for all aspects of administration and maintenance. The *kliang* in *subak* Basang Alas is assisted by a *penyarikan* (secretary) who is responsible for administration and records the *subak's* activities; by a *sedahan daging* (treasurer) who is responsible for *subak* funds; and by one or more *saya arah* (messengers) who transmit messages to the members. The *subak* is divided into seven *subak* subdivisions (*tempek*), each headed by a *kliang tempek*, assisted in turn by a local *penyarikan*, *sedahan daging* and *saya arah*.

Subak Abang has the same structure as *subak* Basang Alas except that there are only two *tempeks*.

Subak Embukan is headed by a *kliang* , assisted by a *penyarikan* and *saya arah*. This *subak* is divided into seven *tempeks*, each headed by a *kliang tempek* who is assisted in turn by a secretary and messengers.

Subak Gunung and *subak* Bekukih have the same structure as *subak* Embukan, except that *subak* Gunung has twenty *tempeks* and *subak* Bekukih has seven.

II. Subak Meetings.

Subak Basang Alas holds regular meetings once every Balinese month (35 days) on Anggara Kliwon. The meetings are preceded by the making of offerings called *beras kuning* . Attendance at the meeting is compulsory for all members and those who fail to attend or who arrive late are fined.

Subak Abang holds regular meetings once every Balinese month on Rabo Kliwon, the meetings are also preceded by offerings of *beras kuning* . Attendance at the meeting is compulsory for all members. However those who fail to attend or arrive late are not fined.

Subak Embukan holds regular meetings once every Balinese month on Jumat Umanis. Again, the meetings are preceded by offerings of *beras kuning* . Attendance at meetings is compulsory for *anggota ngarep* (see page 17); those who fail to attend or arrive late are fined. *Subak* Gunung and *subak* Bekukih have the same arrangements as *subak* Embukan.

III. The Maintenance of the Irrigation Systems.

In *subak* Basang Alas the incidental work is carried out by all *subak* members. A member who is absent or who arrives late to join the incidental work incurs a fine. A regular inspection of the system is done by a team, consisting of members (*anggota ngarep* ; see p. 17) chosen in rotation.

In *subak* Abang the incidental work is also carried out by all *subak* members, under similar conditions as in the case of *subak* Basang Alas. A regular inspection of the system is done by a team consisting of all members. (In *subak* Abang all members are obligated to become active in maintenance).

In *subak* Embukan all the work is done by *anggota ngarep* (see p. 17), who are

responsible for the full-time maintenance of the water system. *Anggota ngarep* who neglect to join the work incur a fine, but those who arrive late are not fined.

The situation in *subak* Gunung and *subak* Bekukih is the same as in *subak* Embukan.

IV. Water Distribution.

In *subak* Basang Alas the water distribution is based on the size of each individual holding; the larger the holding the greater the quantity of water entitlement. Traditional measurements are used (see p. 36).

In *subak* Abang, *subak* Embukan, *subak* Gunung and *subak* Bekukih the irrigation system does not specifically allocate irrigation water to individual holdings; each farmer can tap as much water from tertiary canals as he needs to irrigate his fields. A rotation system is employed.

Errata

1. In the Acknowledgement, reference to "*subak* Ababi" should read "*subak* Bekukih" (Ababi is the village name).
2. P. 18, line 6 : for "*subak* Embukan" read "*subaks* Embukan, Gunung and Bekukih". In line 10, for "*subak* Gunung" read "*subak* Abang".

In line 15: add the explanatory text ("messenger") after "*juru arahs*".

In line 23: for "*pekaseh*" read "*klian subak*".

In line 29: For "*pekaseh*" read "*klian*" in both occurrences.

3. P. 22, line 7: insert "*klian subak* or " before "*pekaseh*".

In para. 4 : add the following text as the last sentence - "In *subaks* Embukan, Bekukih and Gunung, the *klian* and other *subak* officials work on an unpaid, voluntary basis".

4. P. 25, section 3.5 : add as the last sentence - "The interest rate is four percent per month at *subak* Abang, and five percent per month at *subaks* Embukan, Gunung and Bekukih".

Section 3.6 : after the first sentence, insert "*Subak* Bekukih meets on Senin Kliwon, *subak* Embukan on Jumat Umanis, *subak* Gunung and *subak* Abang on Rabo Kliwon".

Last paragraph : before "Attendance at the meeting..." insert "At *subak* Basang Alas,".

5. P. 27, line 7 : add "*Subaks* Bekukih, Gunung and Embukan plan to do the same in the near future".

In line 22 : after " At *subak* Basang Alas" add "and *subak* Abang".

6. P. 38, para.1 : as the last sentence, add "In the case of *subaks* Embukan, Gunung and Bekukih at Karangasem, the ritual is held at the *pura* Jeron Bikul.